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'Boughs gone black and Winterbare
December landscape, Cheshire.

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RESEARCH FOR PLENTY

No. 2. PLACE IN THE SUN

ERIC ASHBY

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WHEN the history of our time comes to be written I'm sure it will be said that our generation was the first to worry seriously about great grandchildren. In the past, many individuals have made careful provision for the generations to come after them. They have planted forests ; they have endowed schools and colleges ; they have laid out gardens and built churches. But ours is the first generation to become really anxious about its successors, and to ask whether they are going to get enough to eat. This series of talks is a symptom of that anxiety. My own contribution to the series is, perhaps, a rash one. I am going to make an estimate of Man's needs and Man's resources, to see whether the world's food budget could, in fact, be balanced at all if our population continues to increase. I'm not going to discuss whether it will be balanced, but whether conceivably it could be balanced.

Before long, the total world population is going to reach some two thousand, five hundred million. Let us make the gloomy assumption that a century ahead the world population will be double this number—that is, five thousand million. Other speakers in this series will talk about the prospects of the farmer and fisherman of A.D. 2052 being able to feed this population. I am discussing a purely scientific problem ; namely, could there conceivably be enough food in the world for five thousand million people ? And by this I mean—is the world's energy income enough to supply all this food ?

The physiologist measures energy in calories, whether it appears as heat or not. It was Count Rumford, who, in 1798, first demonstrated that the energy of animal movement could be estimated as an equivalent of heat. He used the energy of two horses, turning a cannon borer in a steel cylinder, to boil water. The friction of the cannon borer produced heat equal to nine wax candles burning at once, and the Count concluded his report optimistically by saying : " In cases of necessity the heat thus produced might be used in cooking victuals ". In a similar way we can express quantitatively the amount of energy used up in a day by an active man. The figure for this is 2,500 calories. Of course, children and old people use less, and millions of people who do need the full amount are having to do with half of it. But in making an energy balance sheet for man, we should not underestimate the need ; so let us take it at 2,500 calories per day. This is the energy a man consumes, and this is the energy which has to be replaced by food. So the prime function of eating is to acquire energy, and apart from the fact that the body cannot cope with unbalanced diets, it would not matter

which food supplied the energy. The 2,500 calories to keep a man going for a day could come from a couple of pounds of bread, or 11 ounces of butter, or about a pound of peanuts, or 11 pounds of oysters.

When we do a sum to calculate the maximum daily expenditure of energy by a world population of five thousand million, we get a figure the mind cannot easily grasp—twelve and a half million million calories per day. This is equivalent to the amount of energy in something over three million tons of sugar ! So, if the agriculture of the future is to feed double the present population of the Earth, and making allowances for losses and waste, the amount of sugar (or equivalent amounts of starch or fat or animal protein) which the world's crops must provide per day is over three million tons. Energy will have to flow into the human race at this rate ; otherwise some of the human race will starve.

Sugar from the Sun Now let us follow the stream of energy one stage back. Ultimately it all comes from green plants. If you acquire your energy as mutton, you are only getting, at second hand, energy the sheep has taken from Australian or New Zealand pastures. If you acquire it as chicken, you are getting, at second hand, grain from the Canadian prairies. If you acquire it as fish, you are getting what the fish itself took from the microscopic plants of the ocean. How do plants themselves acquire the energy ?

It is no exaggeration to say that this is the most important unsolved problem of botany, for if it were solved we should know how sugar is made from the sun. For that is what happens. Hold out your hand to the sun, and you realize that most of its energy as it falls on your hand is dissipated as heat. But put a green leaf in the sun, and its chlorophyll (the green colouring matter in the leaf) absorbs the energy and holds some of it as chemical energy : it is not all dissipated as heat. This energy captured from the sun is used to remove hydrogen atoms from water (which is in the leaf) and to attach them to carbon dioxide gas (which enters the leaf from the atmosphere). The process of shifting hydrogen from one substance to another is accompanied by the storage of solar energy in chemical form. The commonest chemical form is sugar. The green plant does for solar energy what the battery does for electrical energy in a car—it stores energy in a form that can be released under appropriate conditions. So the world's food supply depends on a photo-chemical synthesis (usually called photo-synthesis)—the synthesis of sugar from carbon dioxide and water, accomplished in leaves by the energy of sunlight.

I suppose more research has been done on this synthesis than on any other problem in plant physiology, and although it is theoretically possible to imitate it (as Sir James Scott Watson hinted in the last talk), no chemist has yet succeeded in doing so. Indeed, it is only very recently, by the use of radio-active isotopes, that the parts played by carbon dioxide and water have been discovered. The process is, in fact, far more complex than the dramatic kinds of synthesis achieved by industrial chemists (plastics and the like), and it is not surprising that it has so far baffled all attempts to understand it. We believe, for instance, that it takes ten steps before the energy is fixed chemically. Our evidence for this is from experiments on the amount of light necessary to add hydrogen to one molecule of carbon dioxide gas : the transformation will not occur at all unless enough light for ten steps has been absorbed by the green leaf. In any fundamental research to increase the world's food supply, an understanding of this synthesis is the most important single objective.

Can the Efficiency of the Plant be Improved ? Even if we do not fully understand photosynthesis —or the process of making sugar from the sun— we know a good deal about the efficiency of the process as an accumulator of energy. I want to turn to this topic for a few minutes. Man lives by energy from the sun. Is there enough solar energy for his needs ? Yes, there is energy and to spare, if only it could be captured and stored as chemical energy. But most of the sun's energy is irretrievably lost to us. More than half of it does not penetrate the atmosphere at all. And of the solar energy which does reach the Earth, much does not fall on plants, and so is lost. And most of that which does fall on plants is not absorbed as chemical energy ; it passes through the leaves, or is reflected from their surface, or is transformed into heat. It has been estimated that no more than two per cent of the solar energy falling on vegetation is converted into chemical energy and stored in the plant. It is a low percentage, and in this very figure you have one problem of research for plenty—how can we increase the meagre percentage of solar energy which is fixed by a plant as sugar ? How can we recover some of the lost ninety-eight per cent of sunshine ?

I will come back to that in a moment. First of all, let us calculate how much solar energy is in fact fixed by plants on land and in the oceans every day. Of course, such calculations as this are very approximate, and they depend on some dubious assumptions; but even if they have the right number of noughts after them they are worth making. Calculations based on the most recent information produce a dramatic result. If two per cent of the solar energy falling on vegetation of all kinds, edible and inedible, is converted to stored energy in plants, this produces an energy income only about a thousand times the energy consumption of mankind in a world with double the present population. This may seem an ample excess—to have an income a thousand times greater than expenditure. But there are vast areas of the Earth's surface which, though they carry vegetation, yet could not conceivably carry any crop plants as we know them today. In fact, only a few million acres of the Earth's surface are considered to be climatically suitable for crop plants, and over a third of this acreage is being cultivated already. These few million acres of land suitable for crops includes what are at present forests and jungles and scrub, and which have not yet been made productive. Out of this energy income all the animals have to be fed too. Indeed, it is a narrow margin : the possibility that Man might not be able to balance his energy budget, if the world population greatly increases, is very real. We have to admit that crops, working at their present efficiency level on all the land we now believe to be capable of cultivation, might barely secure enough energy from the sun to supply daily bread for our great-grandchildren.

Yet the solar energy is there. Ninety-eight per cent of it already falling on vegetation is running to waste. To my mind, the theme of research for plenty is simple to state. It is this—can we train plants to intercept and to store solar energy more efficiently ?

A good deal of the sun's energy we must write off as unavailable to us ; for instance, the sixty per cent which is absorbed by the atmosphere and never reaches the surface of the earth at all. We must be content to try to harness a greater proportion of that fraction of the sun's energy which already falls on vegetation, on land and sea. This fraction alone of the sun's energy should be enough to serve our needs. It is over a hundred thousand times more than the world would need, even if the world had double its present population. So the major problem can now be focused on two questions :

is it possible to increase the efficiency with which plants intercept and store solar energy ; and if it is, by what techniques can it be done ?

The first is easy to answer. If you look through the statistics for yields of wheat or potatoes or maize you find that maximum yields under favourable conditions are sometimes as much as twenty times greater than average yields. Now if the productivity of a factory can sometimes reach twenty times the average productivity of the industry, there is clearly a case for improving the average. And so it is with crop yields. To take an example, the British farmer used to be content with yields of 8–10 cwt. per acre of wheat. Now, on the same soils and in the same climate, his average yield is 20 cwt., and some farmers get as much as 40 cwt. per acre. In regions of primitive agriculture there is even clearer evidence that cropping efficiency can be improved. The demonstration farms in India run by the Ministry of Agriculture commonly have two or three times the yield of the surrounding peasant holdings growing the same crops in the same soil ; and in Soviet Russia, the incentives of "socialist emulation" in farming have more than doubled yields in areas as large as the whole of Britain. There is no doubt whatever that the productivity of crops—the amount of solar energy fixed per acre—could still be greatly increased. And how can productivity be increased ? To put it another way, what are the obstacles to high yields of crops ?

Obstacles in the Way of Higher Crop Yields

First among the obstacles I would put poor husbandry. The farmer is the middleman between the sun and the earth. It is his business to grow his crops in such a way that he intercepts and stores the maximum amount of sunlight per acre. Now you have only to look at the fields in places where agriculture is under-developed to see that half the sunlight is not falling on the crop at all, but on the bare soil, or on weeds which cannot be used for food. Perhaps I should say what the plant physiologist means by " poor husbandry ". He does not regard it from the farmer's point of view, in terms of hoeing, or weeding, or watering, but rather from the plant's point of view. The leaves must be displayed to the sun to enable the maximum amount of light to be absorbed. The roots must live in a soil where there is ample air for their respiration (that is why a waterlogged soil is bad), and where there is a healthy population of micro-organisms to break down manure and other organic materials into simple chemicals which the roots can absorb. The individual plants must not be so close together that their roots are competing for nutrients and water, yet not so far apart that sunlight is falling between them on the bare soil. And there must be a sufficiently high water table to provide a stream of water through the plant all day, for if the water supply fails, even for an hour at midday, sugar production in the leaves may be halved.

One of the chief needs on under-developed farms is fertilization. You cannot grow a good crop in an exhausted soil. Even in the United Kingdom and the United States, fertilizer consumption has almost trebled in the last ten years, and yields have risen correspondingly. Some figures recently published for maize in North Carolina show what can be done by the simple application of better husbandry. Before 1900, the average yield of maize in North Carolina was no more than 14 bushels per acre. In the 1920s an intensive educational programme for better farming, without any scientific innovations at all, brought the yields up from 14 to 20 bushels per acre. In 1943, there was a campaign for more intensive nitrogen manuring and still better farming, and the State set itself a goal of 40 bushels per acre by

1955. This is an increase of 180 per cent in crop efficiency over about half a century ; and this year the farmers of North Carolina are already within sight of their goal. So the first obstacle to higher efficiency in crop production can be overcome simply by education ; it doesn't need research.

The second obstacle is disease and pests. If you have ever seen an Irish potato field infested by blight, or locusts on the plains of India, you need no convincing that the productivity of crops is wrecked by these pests ; and in the next talk Dr. Bawden will no doubt explain how scientific research is removing part of this obstacle.

Then, there are the obstacles to higher productivity inherent in the crops themselves. Is there any prospect that plant physiologists can make the process of photosynthesis itself more efficient ? My own guess is that physiologists will not, for some time to come, be able to accelerate the reaction ; they are not yet familiar even with the steps by which it occurs. But they can do a great deal indirectly to improve the efficiency of a crop. Any treatment which increases the area of leaves exposed to the sun will increase the productivity per plant. So will any treatment which increases the thickness of the leaves so that they intercept more light. So will any treatment which produces deep, instead of spreading, roots ; for then the plants can be grown closer together. In brief, the plant physiologist can discover new patterns of crops designed to intercept the maximum amount of sunlight. To mention one example—a variety of cotton which produces long branches at the base is more efficient than one which does not, for the long branches throw the lower leaves of the plant well outside the shade of the upper leaves ; and in one case this has already been proved to increase yield. Another contribution the physiologist makes is to study how crops maintain their efficiency in unfavourable conditions—during droughts, or in cold or dull weather. These are problems to which Russian and Canadian workers have made important contributions. Russian plant physiologists, for instance, have discovered a good deal about drought resistance, and Canadian workers have paid particular attention to frost resistance. Farmers using their results have pushed the agricultural frontier of Canada and Russia many miles nearer the Arctic.

Finally, the plant breeder has a contribution to make. He can select varieties of crops on a basis of their efficiency as interceptors of solar energy, and can even breed deliberately for large leaves, and for a high efficiency in utilizing sunlight. I would like to finish with a striking example of this. By hybridizing inbred varieties of maize it is possible to produce strains which, on account of their greater size and vigour, intercept and store much more solar energy than the parent strains from which they came. Twenty years ago, these hybrid strains were scarcely to be seen at all in the Corn Belt of America. Today, over four-fifths of the maize in the Corn Belt comes from hybrid strains. Now other conditions of cultivation have not changed much ; yet the maize yields from the Corn Belt have gone up by 500 million bushels a year. That is an increase in crop efficiency of 25 per cent in twenty years. Just as the speed of an aeroplane can be improved by introducing a new wing-shape, so the yield of a crop plant can be improved by introducing new patterns of leaves and branches and roots. It is said that the use of hybrid corn has virtually provided enough additional pig meal to give every man, woman and child in the United States another 50 lb. of pork a year–which demonstrates that the benefits of research for plenty are not only for our grandchildren.

SUGAR BEET HARVESTING : PROBLEMS AND PROGRESS

CLAUDE CULPIN, M.A.
Chief Farm Machinery Adviser
National Agricultural Advisory Service

How far are modern machines helping towards the efficient harvesting of sugar beet ? Mr. Culpin examines some of the problems and the progress being made.

BRITAIN'S sugar beet crop—amounting in recent years to some 410,000 acres—is produced on about 41,000 farms. The average amount grown per farm is thus 10 acres ; and there are only about 4,000 farmers who regularly grow over 20 acres. Bearing in mind these figures, the progress achieved in mechanizing beet harvesting operations over the past five years or so is striking. The machinery census of January 1952 showed that there were just over 2,600 mechanical toppers, 3,100 lifter-cleaners and 1,500 "complete" harvesters on British farms ; and the British Sugar Corporation has estimated that about 20 per cent of the 1951 crop was harvested with the help of such machines.

A statistically-minded planner might find these figures a little alarming if he were also given the fact that some scores of complete harvesters have been shown capable of dealing with over 100 acres each per season ; but it must not be imagined that all of the 1,500 listed are capable of doing this, and the difficulty in arranging for a full utilization must not be disregarded. So far as harvesting the roots is concerned, the standard of the work done by the machines has been on the whole satisfactory, dirt and top tares being on average very close to those for skilled hand work. There remain, however, many problems of development, choice and operation of mechanical harvesting devices, and these are discussed in some detail after the principal types of machines concerned are distinguished.

On about 60 per cent of the beet acreage the tops are fed to livestock, most of them being either fed where grown or carted to stock for feeding fairly soon after the beet harvest. From the national aspect, the failure of farmers on the other 40 per cent of the acreage to make the best use of the beet tops presents a difficult problem. Experiments carried out over a long period at the Norfolk Agricultural Station and elsewhere have clearly shown that the beet tops are equal in food value to a similar weight of swedes, and that though their manurial value when ploughed in is appreciable, the practice of ploughing them in is about as doubtful a proposition as is growing any other sort of fodder crop merely for green manuring. There is little doubt that more of the 160,000 acres of tops which are annually ploughed in would be conserved for feeding stock if a suitable mechanized method of collecting and ensiling them were shown to be practicable, and one of the most important trends for farmers to study this year will be the progress being made in this direction. Most farmers today are interested in the fate of the tops as well as the roots, and there can be little doubt that an ever-increasing number of farmers in the future will want to use only those machines which make it possible to secure the harvest of tops in good condition, as well as the harvest of roots.

Types of Machines Farmers who wish to mechanize beet harvesting have a difficult task in deciding what type of machine is best suited to their requirements ; for quite apart from the fact that the

mechanisms employed for doing the same job often vary widely on different manufacturers' machines, the functions which the machines are designed to perform may include one or more of the following :

1. Topping the beet.
2. Windrowing, or loading the tops.
3. Lifting and cleaning the topped roots.
4. Windrowing, or loading roots into various kinds of trailers.

Price of the machine is often a deciding factor ; for whereas relatively simple toppers and lifter-cleaners may be within reach of farmers who grow quite small acreages, the purchase of a complete harvester which tops, cleans and loads the beet can usually be economically justified only if the machine is to deal with a reasonably large acreage.

So far as harvesting of the roots is concerned, it is true to say that there is now available a machine or a pair of machines which should be capable of doing the job satisfactorily on most farms where not less than 10–20 acres of beet are grown. There are still difficulties on very heavy land when it is wet, also on some kinds of stony land ; but most harvesters will now tackle all but the worst conditions if used as they should be. For farms which grow much less than 10 acres, however, contract work may sometimes be a better solution than buying a machine. Unfortunately, most of the growers of small acreages do need to feed the tops, and harvesting the whole crop in a few days introduces extra difficulty in using the tops to best advantage. It must also be borne in mind that the factory loading permit system has had to be introduced to overcome the difficulties caused when too much beet is lifted and loaded early in the season. Beet will keep well in clamps for a time, but roots lifted in October cannot be held till December.

Need for Careful Operation and Planning Sugar beet harvesters are not so completely fool-proof as to be capable of producing satisfactory results without careful operation. Planning for use of a harvester should begin a year ahead of the actual harvest, when the land is being ploughed in preparation for the crop. "Square" or "one-way" ploughing, followed by thorough seedbed preparation, dead straight drilling, and the use of machines and singling methods which produce a regular plant, all contribute to the production of the type of crop which suits a harvester, namely one that is clean and uniform. All machines have their topping mechanisms designed to adjust themselves for roots of different sizes ; but no machine is so perfect as to be capable of first-class work in crops which vary greatly from point to point in the field.

In drilling, the field should be set out with a headland about 15 yards wide, so that after the headland rows are lifted the harvester can set in square to the work without the necessity of a lot of manoeuvring.

Where mechanized harvesting methods are to be employed, row widths need to be chosen with the needs of the harvesting equipment in mind. It is particularly important with some types of two-row lifter-cleaners that farmers make their row-widths suit the machine chosen. Eighteen-inch rows, which may have been the optimum for hand harvesting methods, may be a little too close for efficient work with many types of harvesters. Modern tractors are often fitted with 11–36-inch tyres, and these are apt to damage the beet and interfere seriously with the work of the harvester if the rows are less than 20 inches wide.

Setting Beet Toppers The general shape of the beet on different fields and in different seasons, and even in different places on the same field, often varies considerably ; and it is essential for farmers to pay particular attention to the adjustment of topping devices. The vertical position of the topping knife or discs can always be varied within certain limits in relation to the bottom of the feeler wheel or track, and a correct setting can be achieved only by trial and error. Undertopping will be penalized at the factory, while overtopping can also lead to considerable financial loss, especially if the tops are not efficiently utilized. A second adjustment of the topper enables the downward pressure on the feeler wheel to be varied. It must be sufficient to ensure that the feeler spikes get well down to the beet crowns but not so great that the machine is tending to run with its weight on the feeler wheels, rather than on the skids or other devices which are designed to secure accurate steering. Accurate steering of the topper is, of course, essential ; unless the feeler wheel runs along the row centre, accurate topping is impossible.

On most machines the horizontal distance between the centre of the feeler mechanism and the edge of the knife is adjustable. It needs to be varied according to the average diameter of the beet crowns ; and, as a general rule, the knife should be just beginning its cut when the feeler wheel is above the centre of the crown. Serious errors in this setting lead to the roots being topped obliquely.

Topping knives need frequent sharpening, and as this is not easily done with a file it is usually worth while to have some spare knives available, so that the blunt ones may be taken to the workshop and sharpened on an emery wheel without holding up the work.

Setting Lifter-Cleaners and Harvesters An important requirement in all devices used for lifting and cleaning the topped beet is to lift the roots with a minimum of soil adhering to them. Lifting shares must be set deep enough so that few roots break and leave the lower part in the ground ; but it is usually a mistake to set shares so deep that a great volume of soil enters the cleaning mechanisms with the roots.

Some of the simpler lifter-cleaners have a ground-driven cleaning cage, but others and most harvesters have the cleaning devices positively driven from the tractor P.T.O. In general, the types with ground-driven cages are suitable mainly for light land where little cleaning is needed. Adjustment devices are provided to vary the length of time the beet remain in the cage, the roots being retained longer where more knocking is necessary.

On heavy land, where a good deal of knocking is needed to get the beet reasonably clean, it is necessary to arrive at a compromise between getting the roots clean and doing too much damage to them in the process. Where power-driven knockers are used, it is possible on some machines to bruise and cut the roots severely, and this may lead to trouble from rotting, etc., if the roots are left long in clamp before being processed. Care must be taken to keep the degree of agitation to the minimum necessary. Adjustments provided may also include variation of the speed and amplitude of the knockers.

One of the problems arising in the use of separate toppers and lifter-cleaners is the devising of a satisfactory method of getting the tops cleared in advance of the lifter without running over the unlifted beet and so making lifting more difficult. Some farmers use side-delivery rakes to move the tops to one side, but it cannot be pretended that this is an ideal solution,

since it involves additional journeys up and down the field, and also often results in the tops getting badly soiled. For this and other reasons, the development of cheap topper-loaders is a matter of great interest to many farmers.

Frost Damage and Loss of Sugar Where topping and lifting are carried out as separate operations, it is inadvisable to allow the topper to get far ahead of the lifter-cleaner. Beet which have been topped and left in the ground are very susceptible to damage by frost, and at the same time they lose a percentage of sugar which is likely to be only partly compensated for by some increase in weight. Experiments at the Norfolk Agricultural Station have shown that sugar percentage loss in topped beet that remain in the ground may be 1 per cent after a week and 2 per cent after a month. In general, the topper should not be allowed to get more than a few days ahead of lifting, especially in view of the frost risk. Beet which have been lifted and left by the harvester in thin windrows are also liable to serious frost damage, and it is partly for this reason, as well as on account of the saving of labour, that machines which load the roots directly into trailers are finding increasing favour, especially on the larger farms.

Transport One of the important factors which must be considered in choosing mechanical harvesting machinery is the transport system that is to be employed. With hand topping methods, transport and lifting can be quite independent of one another ; but efficient use of many kinds of harvester necessitates using a particular system of transport. Side-loading harvesters require a tractor and tipping trailer, or more rarely a motor lorry, in attendance all the time the machine is at work. This usually means that at least three tractors and four men are needed for the job—clearly out of the question for many small farms. With a machine which delivers into a rear-attached trailer the beet can be collected and dumped on the headland by the use of one tractor and two men ; but this system may give some trouble with a light tractor in difficult soil conditions.

When the tops are being collected and carted off, transport becomes a very serious problem. It has now become possible for the tractor pulling a top-saver to run outside the unlifted crop, so avoiding the disadvantage of running down the rows before the beet are lifted.

Making Beet-top Silage The preservation of a substantial proportion of the harvest of sugar beet tops could make a great contribution towards achieving self-sufficiency in animal feedingstuffs on many farms, and for this reason the methods of ensiling them that have been tried out in Britain recently are of considerable interest.

At last year's National Beet Harvester Demonstration, several types of silos were filled with tops—some with whole tops and some with tops chopped by various types of machine. The silos were filled and consolidated quickly, the aim being to employ the " cold fermentation " process that has recently been adopted on a wide scale on the Continent. When the tops came to be fed it was found that some good silage had been made by this method, which seems well worth consideration in circumstances where the tops cannot all be used before they deteriorate.

As with other kinds of silage, making good beet-top silage seems to depend on securing a high degree of acidity in the silo through the development of a type of fermentation which leads to the production of lactic acid. Insufficient

consolidation or dirty tops may lead to the formation of an evil-smelling silage containing butyric acid. Chopped silage is much more easily compressed than unchopped, and chopping also helps to secure a rapid intermixing of the sugar in the crowns with the leaves.

A good deal of work on this subject in Denmark and Holland has shown that chopping is worth while, leading to the formation of a silage with a better smell, colour and texture, and also to a smaller loss of dry matter. It is essential that the beet tops ensiled should be as clean as possible, since contamination with soil not only tends to produce a poorer type of silage, but will also lead to digestive troubles when fed. Top-saving machines which load directly on to trailers clearly have an advantage in this respect. Various kinds of choppers are becoming available, and research is being undertaken to determine just how finely the tops need to be chopped.

RECLAMATION ON AN UPLAND RADNORSHIRE FARM

R. WATKINS

Dolau House, Dolau, Radnorshire

Mr. Watkins is one of the pioneers in the reclamation of rough hill country in Radnorshire. In this article he describes how, over the course of thirteen years, he has successfully turned more than 130 acres into good stock-grazing land.

DOLAU HOUSE FARM is situated near the village of Dolau, nine miles to the north of Llandrindod Wells in Radnorshire. Of its total area of 772 acres, some 252 acres are in-bye land, consisting of 146 acres around the homestead and buildings of Dolau House, and 106 acres attached to a separate holding known as Cwm. The remaining 520 acres are enclosed hill land. This hill land, which lies at an elevation of 1,200–2,000 feet, is part of the Radnor Forest, and includes two adjacent areas of land known locally as the Fronwen and Domen Hills. It was on these two hills that the reclamation work described in this article was carried out.

The system of farming at Dolau has always been the production of store cattle and sheep, and the breeding and rearing of cattle follows the traditional practice in the county. Most of the breeding cows (Herefords) calve in the spring, and each cow suckles her own calf. The calves are weaned in the autumn, fed indoors during the winter, and sold off grass as stores in the following autumn. In addition, it has always been my custom to run two breeds of sheep, and, before the reclamation work began in 1939, 190 Welsh Mountain ewes were kept to range on the hill land, with another flock of 150 speckled-face, hardy Kerry ewes on the in-bye land. The wether lambs were fattened on roots and rape, and most of the ewe lambs were retained to replace the draft ewes sold in the autumn.

When reclamation work on Fronwen Hill began in the spring of 1939, most of the ground was covered by a dense growth of bracken, but a considerable area was suitable for ploughing. A block of 18 acres (Block 1)

was fenced and ploughed one way by a tractor and a heavy plough. Soil analysis showed a deficiency of lime and phosphate, and so a dressing of 50 cwt. per acre of ground lime and 12 cwt. per acre of good quality slag was applied. The furrows were worked down by a disc harrow, and the land was sown to a pioneer crop of rape. The resultant crop, which was very successful, was fed off to the wether lambs, and, in the following year the block was seeded down under rape. The results were again very satisfactory ; a good sward was established and it remained highly productive during the following four or five years. By 1946, however, there were signs of deterioration and reversion in the sward, so it was once more ploughed up and reseeded direct.

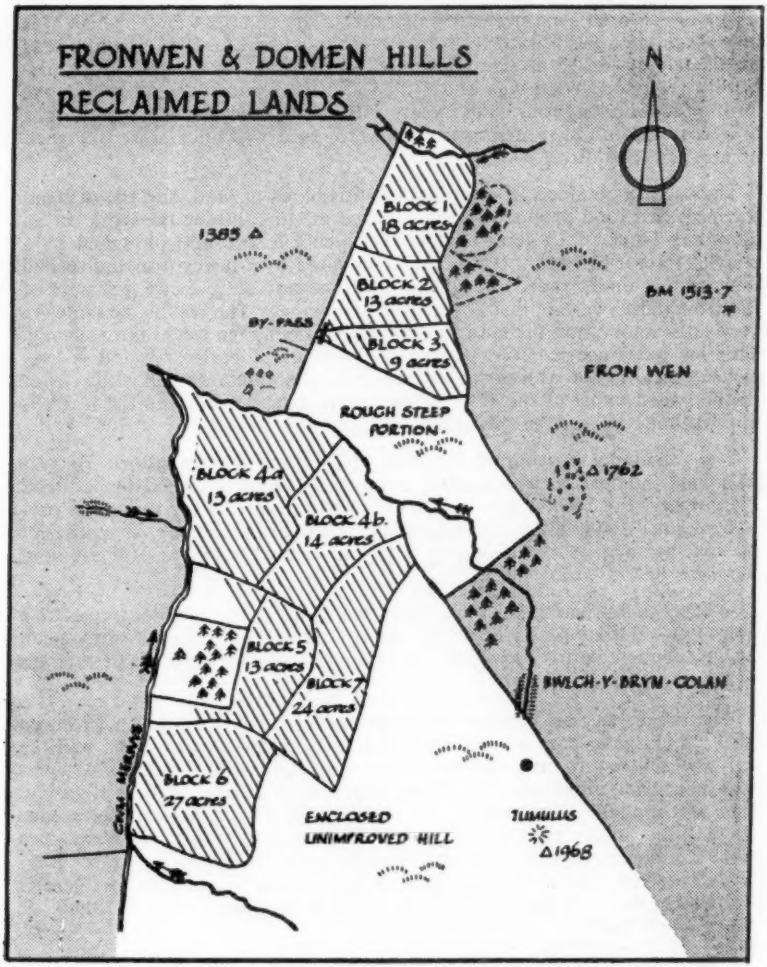
The success obtained from ploughing this block of land, and the demand for increased food production, encouraged me to continue the work on an adjoining block of 13 acres (Block 2), which I fenced and ploughed by a crawler tractor in 1941. It was then cultivated by a heavy disc and seeded down direct under rape. In addition to lime and slag, 2 cwt. per acre of "Nitro-Chalk" was applied at the time of sowing. The results, again, were very satisfactory, and the land was ready for grazing ten weeks after sowing. This ley has since received periodical dressings of basic slag and is now eleven years old but, although there is still an abundance of wild white clover in the sward, most of the sown grasses have disappeared, and the block is approaching the stage for ploughing up again and reseeding.

The remaining portion of Fronwen Hill—some 9 acres (Block 3)—was ploughed and dealt with in a similar manner in 1942, and seeded down direct. Here again, the results gave every satisfaction and the ley remained productive until 1948, when it was again ploughed and reseeded. Dressings of 10 cwt. per acre of basic slag in 1949, and 3 cwt. per acre of compound fertilizer in 1951, were given.

When fencing the last block, steps were taken to provide access to a common water supply in Block 2. Block 1 was provided with water from an independent source, so that it has been possible to graze all three areas in rotation.

The conditions on Domen Hill were very similar to those on Fronwen Hill ; the greater part was covered by a dense growth of bracken, and the soil was deficient in lime and phosphate. To start with, a block of 27 acres was fenced and ploughed in 1943, and a dressing of 50 cwt. per acre of ground lime was applied. A part of this area—Block 4a (13 acres)—was then seeded down direct under rape, and the remaining 14 acres (Block 4b) were sown with a pioneer crop of rape, and seeded down the following year. Both areas received a good dressing of slag and, in addition, 2 cwt. per acre of "Nitro-Chalk". A second dressing of basic slag was given to Block 4b when it was seeded.

The reclamation work was continued in 1945, when a further 13 acres (Block 5) were fenced, ploughed and sown down to rape and Italian ryegrass prior to reseeding the following year. In 1949 another block of 27 acres (Block 6) was dealt with in the same way : 18 acres of this area was seeded down direct under rape, and the remaining 9 acres to a crop of rape followed by reseeding the following year. The last block of Domen Hill was ploughed up in 1951—Block 7 (24 acres)—and sown with rape. With the reseeding this year, this completes a total area of 91 acres reclaimed on this hill. All the areas received the same treatments of lime, basic slag and nitrogen as in the earlier work.



The pattern of reclamation on the Fronwen and Domen Hills. As the result of the improvements made on these 131 acres of rough hill land, the total number of cattle kept on the farm has been almost trebled, and the production from sheep in terms of mutton, wool and better quality draft ewes nearly doubled, as compared with 1939.

Drawing Conclusions As a result of the experience gained during the twelve years the work has been in progress, it is now possible to draw certain general conclusions. Thus, on these hills, the first week in July seems to be the best time to plough for a complete kill of bracken. As soon as the ploughing and cultivations were completed and the land limed and slagged, it was my practice to sow the land either direct with a grass and clover seed mixture or with a pioneer crop of rape. Sometimes it was not possible to complete the whole block, and a part was left fallow until the following year. Although this delayed the ultimate seeding down, the trial results were better in that a heavier crop of rape was obtained after fallow, thus providing higher fertility in the seeding year.

With the exception of Block 1, all the initial ploughing and discing involved crawler work with heavy implements, which was carried out by the Radnorshire A.E.C. The matted turf and dense growth of bracken could not be tackled satisfactorily by my own tractor and implements. Once this initial work was completed, however, the subsequent operations were much easier, and, in future, it will be possible to plough and complete all cultivations on the area with my own equipment.

The application of adequate quantities of lime and phosphate to make up for the natural soil deficiencies is essential to success. In addition, it is necessary to give a dressing of nitrogen to the pioneer crop and, again, to the young seeds. A good crop of rape fed on the ground builds up soil fertility and is an excellent preparation for the young grass and clover seeds. An application of nitrogen when seeding down encourages quick growth and establishment of the sward.

Rape has always been included as a nurse crop to the young grass and clover seeds. It was found that not more than 2–2½ lb. per acre was necessary —a heavier seed rate had a smothering effect. A small quantity of rape increased the production during the seeding year and, in very dry, hot weather, the plant gave protection and shelter to the grass and clover seedlings.

The introduction of a local lime spreading service has considerably eased the operation of liming. The carriage of the lime on to the hills and its subsequent spreading on the land took up considerable time and energy during the earlier years.

Improvement of the In-bye Land As the productivity of the two hills increased and it became possible to carry more stock on them, so in turn there came the problem of providing additional quantities of winter keep. Accordingly, while the reclamation work was progressing on the hills, production was stepped up on the in-bye land, the greater part of which was, at the outbreak of war, in old pasture.

As the new leys on the hills came into production, it was possible to relieve the in-bye land of stock three to four weeks earlier in the spring, and thus devote more of this land to the growing of food for wintering the extra stock. Two-thirds of this in-bye land has now been ploughed and is being farmed on a ley system with a rotation of wheat—oats—roots and potatoes—seeds under mixed corn. The seed mixture used is a long-duration, general-purpose mixture for hay and grazing. All this land has been limed and slagged at intervals and nitrogen has been applied as required to produce early grass, hay and arable crops, and, as the result of the better leys now maintained on this in-bye land, together with the fact that the greater part of the stock are on the improved hill pastures from mid-April to the end of the

year, I can now conveniently devote about 55 of the 252 acres to the growing of cereal and root crops.

The remaining one-third of the in-bye land is retained as permanent pasture. It is not suitable for ploughing up and is particularly useful as dry land where stock can be fed during the winter months without likelihood of poaching.

More and Better Stock From the comparison of numbers of stock on the farm before and after reclamation given below, it will be seen that the total number of cattle has nearly trebled in thirteen years. In addition, it has been possible to pay more attention to the quality of the cattle by improved breeding. The steers are sold off as forward stores in the autumn, at 18–21 months, and weigh between 8¾ and 9 cwt. The heifers not retained for breeding are sold off the hills at the same age.

	1939	1952
Breeding cows	14	36
Other cattle	41	106
TOTAL CATTLE	55	142
Breeding ewes	340	380
Other sheep	740	760
TOTAL SHEEP	1,080	1,140

The reduction of rough grazing and the increase in leys has led to some change of emphasis in the sheep population. Thus while the Welsh Mountain ewes have been reduced from the 190 kept in 1939 to the present number of 95, the number of hardy Kerry ewes has been increased from the original 150 to 285. The wether lambs are fattened on the leys and rape, and grade at 48–50 lb. dead weight. I usually sell about one hundred breeding ewes from the Kerry flock in the autumn, at 2½ years old, keeping the remainder for breeding and sale a year or two later. The ewe lambs are kept for flock replacements.

The Welsh Mountain ewes are run on the unimproved part of the enclosed hill during the summer months. Half the ewes are mated to a Welsh ram, and the ewe lambs are retained for replacement : the others are mated to a hardy Kerry ram, and the ewe lambs from these are kept for breeding, and mated to a better type of hardy Kerry ram to provide replacements for the improved flock. As a result of these improvements, the total production from sheep in terms of mutton, wool and better quality draft ewes is nearly double that of 1939.

It has been necessary, in recent years, to buy in additional stock to graze and utilize the improved land during the growing season. The number depends on the seasonal growth of grass, but anything up to 35 heifers and 100 good class wethers may be bought in the spring and sold off in the autumn.

The health of the cattle and sheep on the improved land has been excellent, and the losses, apart from those suffered in the severe winter of 1946–47, have been negligible. The condition of both cattle and sheep, and their growth during the time on the hill, have been very satisfactory.

Production by the Plough The reclamation of the hills involved considerable expense on fencing material, lime, fertilizers and seeds, as well as time and labour on haulage, fencing and cultivations. The reclaimed land lies at an elevation of between 1,200 and 1,400 feet, and both the land and access roads are, in parts, steep and difficult. Nevertheless, I have endeavoured to maintain the improvement and make as full use as possible of the increased productivity of the land. The reseeded areas have received a dressing of basic slag eighteen months after seeding down and again at intervals of three to four years. A dressing of nitrogen or complete fertilizer is also applied to produce grass in early spring, late autumn or other specific periods.

The fencing of the area into convenient blocks with access to water supplies has made rotational grazing practicable, and, in consequence, it has been possible not only to keep most of the leys in good production for seven or eight years, but also to have a longer grazing season. A block is rested in July to provide keep in November and December, and another is rested in the autumn for grazing in the early spring. In time, of course, reversion takes place on these hills ; inferior grasses creep in, and the only remedy appears to be ploughing and reseeding. My intention therefore is to maintain production by the use of the plough.

Finally, I would like to pay a tribute to my workmen, whose enthusiastic co-operation throughout the whole reclamation work contributed so greatly to the success of my endeavours.

TOWARDS BETTER ENGLISH BACON

H. Martin Lewis

In this paper, read at a recent N.A.A.S. conference at Calne, Wiltshire, Mr. Lewis points to the need to give the home bacon market the kind of pig that the curer wants.

THE Wiltshire bacon trade now means the general trade in bacon, cut and cured in what is called the Wiltshire style, and includes both home-produced and imported bacon. When I entered the trade in 1906, the term " Wiltshire bacon " had a different meaning. Then, Danish bacon was hardly known on this market, and Irish bacon and hams and American drafts and hams were the main imported supplies. What was then known as " Wiltshire bacon " was cured and sold by not very many English factories and it was almost entirely a direct trade between the curer and the retailer, and essentially one for a branded bacon.

During the period 1906 to 1914 the Danish bacon industry was expanding very rapidly, as also was the use of bacon-slicing machines ; the whole nature of the bacon trade was changing. The old-time custom of a housewife buying a piece of bacon, and cutting it up in the kitchen as required, was ending ; the days of the large family were ending too. The whole social structure was changing ; motor-cars and motor-buses were coming into general use, and people were living "softer" and did not need so much fat in their food.

Imported Bacon on the British Market

With the spread of the bacon-slicing machines, the housewife was attracted to buying her bacon in rashers, and the demand became more and more for small lean bacon, which would enable the shopkeeper to cut rashers from a back of bacon, totalling about 12–14 rashers to the pound. Now I want to emphasize that the Danes were very much alive to these facts, and they strove continuously to do everything they could to make their pigs fit this demand : each year saw the shape of their bacon becoming more and more suited to it. Moreover, they had the invaluable supply of separated milk, arising from their butter industry, to secure the right kind of feeding to the right type of pig. Meanwhile, the English Wiltshire curer was competing for his pig supplies with the Midland and North of England curers, who, at that time, could take big, heavy pigs, and were mainly concerned with the ham trade, the fresh pork trade and the general trade in offals as a by-product of their pigs ; the shoulder belly (left after cutting out the hams and the lengths of pork) was the least important item in their production. So long as the home pig producer had this dual market for pigs, it is perhaps not surprising that he failed to realize, or to trouble, that the English Wiltshire curer could not hope to survive unless his raw material was brought into line with modern demand.

The new, greatly increased, consumption of bacon which became possible from the new source of supply from Denmark, was soon further increased by the introduction of other Continental supplies, and also from Canada : and while a vast new market in bacon was thus developed in this country, the home pig producer sat back and took little part or interest in it. In the meanwhile, the multiple shop was rapidly spreading all over the country and, speaking generally, all the multiple shops went for the imported bacon : the English Wiltshire curers had to rely on the goodwill they had established with some of the private shops, and trade on this goodwill. So far as price was concerned, they could not begin to compete with the imported bacon. But as the old generation of retailers died or retired, more often than not their businesses were bought up by a multiple concern, and so yet another customer was lost to the home curer.

Then came the first world war. Following this, the Danes were quickly back to work, and for two or three years after 1918 the business was very profitable to them, encouraging even greater production. Other Continental countries also rushed into bacon production and, with Britain their only market, and no control over imports, by 1928 the position for the home producer had become very serious. The market was simply swamped with bacon, and prices fell to utterly uneconomic levels. Nevertheless, all the time, the imported bacon was continually graded up and up, and the emphasis on production of a uniform standard selection of bacon was never lessened.

In 1934, by the setting up of the Pigs and Bacon Marketing Schemes, some control over imports was secured, and for the first time some real interest was shown in the home bacon industry. Grading of pigs was introduced, and we certainly began to see an improvement in the quality of pig delivered ; also, with the curtailment of imports, the retail trade was forced to take more interest in the home-produced bacon. Even so, the production of Wiltshire-style bacon from home pigs over 1936, 1937 and 1938, averaged only 1,230 tons per week. Then, in 1939, came the second world war and everything went overboard. During the war, Continental supplies ceased and the only consideration at home was to produce such

pigs as could be fed on what feedingstuffs could be provided ; all we can say is that pig-meat of all sorts and sizes was cured and called bacon.

The end of the war, however, found Canada still sending us a certain amount of bacon ; also we learned that, in Canada, even during the war, they had never lost sight of the supreme importance of producing the right type of pig, and they were still paying strict attention to this. Since then, of course, Denmark has come back into production, and here again there is once more intense effort to deliver the pre-war standard of bacon.

The Right Kind of Pig If we want to take our proper place in supplying the home market the time has now come when we, too, must start to concentrate on producing the type of pig that will yield bacon comparable with that of Denmark and Canada. The curers can definitely do their part.

What exactly do we want ? We want long, lean-cutting pigs with firm white fat, with a wealth of flesh along the back, with light shoulders, full hams and a minimum weight of head and feet : also we want white pigs.

Now the bacon curer and the retailer are not only concerned with what the consumer wants, but they are in business to earn a profit ; and in this connection they are very much concerned with the features in the conformation of a pig that are essential to this.

Take first the curer : he buys a pig and sells two sides of bacon and the offals ; he wants the two sides of bacon to show as large a percentage of the weight of pig as it is possible to secure ; therefore he wants a light head and light feet and a long body. This question of conversion factor is now of the utmost financial importance, in view of the very high prices involved. At the moment, the price of green sides, sold by the curer, as an agent of the Ministry of Food, to a wholesaler, is 323s. 6d. per cwt. If he kills a thousand pigs in a week, averaging 8 scores each, that is 1,428 cwt. of pig weight. A variation of 1 per cent in the yield of bacon weight means 14¼ cwt. of bacon, which, at 323s. 6d. per cwt., equals £230.

It will therefore be appreciated how vital to the curer is the percentage yield of bacon he obtains. I have been told, but cannot say how true it is, that the Danish pig gives about 4 per cent better yield of bacon than we obtain.

Now for the retailer. He buys a whole side and he is vitally concerned with how it cuts up. It divides first into fore-end, middle and gammon. The fore-end is the least valuable cut and therefore he wants it to represent as small a fraction of the whole side as possible. Again, the middle is divided into back and streaky. He wants as much of the weight as possible to lie in the back. Overall, he wants the fore-end to represent less than a quarter of the weight of the side, the gammon fully a quarter, and the middle rather more than half.

Finally, I said we want *white* pigs. The reason is that there is great risk of the belly of a black pig being marked with what is called "seedy-cut", which is a nasty black deposit arising from the pigments of the hair. This ruins the side, as it has to be cut away, thus spoiling the look of the side and also reducing the bacon conversion factor. Moreover, it is not always possible to make the carcass of a black pig look as clean and attractive as that of a white pig ; and this applies particularly to the head. I ought perhaps to say we want white or mainly white pigs, because when a large white boar is used on the gilts of the coloured breeds the objections I have stated are overcome.

I have tried to show that prior to 1939 the enormous sale of Wiltshire-cut bacon in this country had grown up over a period of only about thirty-three years, including the first world war, and that the home producer had taken very little part in it. Now we have a new opportunity of doing so ; but we can only hope to succeed on merit.

If we produce bacon inferior to that of our competitors we shall only be able to market it at a lower price, and I cannot see any Government helping to keep home bacon production alive if the bacon is not at least as attractive to the consumer, and to the retailer, and to the wholesaler, as is the production sent us from overseas.

As to how the home producer is going to set about providing the home curers with the right pig, I think I am not called upon to say. I should, however, like to stress that this seems obviously to depend mainly on the pig breeder. Very many of the feeders who actually deliver the bacon pigs to the factories have to rely on other people to breed the pigs, and so production of bacon pigs concerns two classes of people—the pig-breeders and the pig-feeders. The latter cannot buy the right type of pig if it is not available. All they can do, is to feed properly balanced rations and take care to deliver pigs for slaughter at the right weights. Where the breeders are concerned, I would suggest that the aim of every Breed Society should be to produce the type of pig the bacon trade requires, which will be equally suitable for the pork trade : without a definite aim on the part of the breeders, very little progress is possible.

Conformation and Balanced Feeding

For some months now we have had what the Ministry of Food calls " educational grading ", and all that this has done is to show us what pigs did not exceed 2¼ inches of fat on the shoulder. I agree that knowledge of all kinds is useful, but beyond that I see no value in this present grading and, as the result of it, the classification of large numbers of the pigs as " Grade A " has been, in my opinion, most misleading to the pig producers. Measurements of back fat alone can never indicate the extent to which we are producing the right type of pig. As I have stated, this is determined by :

1. The percentage of the carcass weight that can be obtained from it in the form of two sides of bacon.
2. The various proportions of fore-end, back and belly, and gammons that those sides will yield when cut up.
3. The quality of the fat and the degree of fat.

By far the most important of these three matters are the first two, because if we get the right conformation in our pigs the question of quality of fat and degree of fat will be simply a matter of feeding a properly balanced ration. On the other hand, if, in their conformation, pigs are too heavy in the head and in the shoulder, too short and too wide in the middle, and too light in the gammons, the most efficient feeder cannot possibly turn them into good bacon pigs. Having regard to the very mixed types of pig we now have to deal with, I think the best average weight at which to slaughter them is about 7 score 15 lb. dead weight, yielding smoked sides of about 58 lb., but when we secure greater length of middle and more standardization it will be possible to increase the weight. The Danish sides are now averaging about 66 lb. which is substantially more than the pre-war average. I have been concerned to show that prior to the war we had actually taken but little part in supplying Wiltshire-cut bacon to the home market ; but, today, we are supplying well over 4,000 tons per week. How far is this meeting the requirements of the trade ?

TOWARDS BETTER ENGLISH BACON

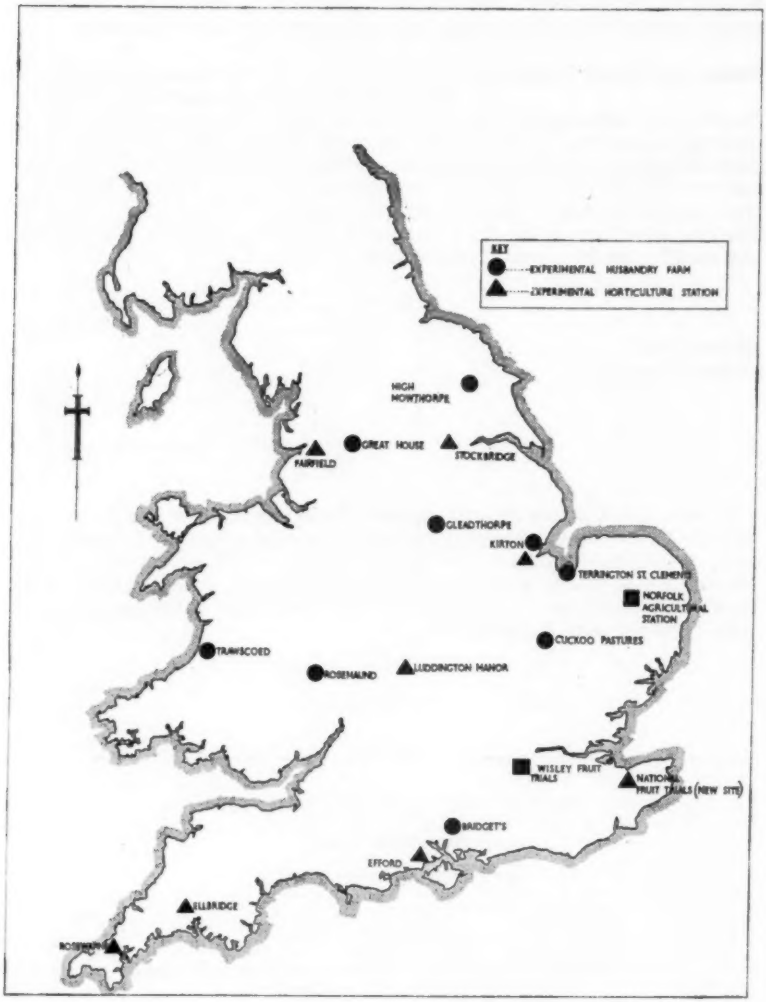
Bacon is still a rationed food and we now have a very different position from that which will arise when we come back to a free market and there is competition to sell. I think, at present, English bacon is rather like the curate's egg—some of it is very good, but some is not. If we want not only to maintain but, as I hope, substantially to increase our present share in the home market, we must so improve and standardize our production that English bacon as a whole, and not merely some portion of it, will stand up to any comparison with anything that can be sent to us from overseas.

Danish and English Compared I wrote to a well-known firm of wholesalers dealing with very large quantities of both English and imported bacon, and I asked them if they could give me a detailed comparison of typical Danish and English sides. Actually it is very difficult to make such a comparison, because the Danish is so uniform, and it is difficult to say what is a fair sample of English bacon. However, from an average side of Danish and a fair sample of only the better type of English, they have made the comparison most favourable to the English that could be made. This is what it shows :

	Danish			English		
	lb.	*oz.*	*% of side*	*lb.*	*oz.*	*% of side*
Weight of Side	62	7		62	14	
Weight of Fore-end	15	9	24.92	17	5	27.54
„ Gammon ..	15	3	24.33	14	13	23.56
„ Back	20	4	32.43	19	5	30.72
„ Streak	11	7	18.32	11	7	18.18
	62	7	100.00	62	14	100.00

In each case the fore-end cut included three ribs, the gammon cut one inch above the round bone, and the middle divided according to trade custom. It will be noted that 56.76 per cent of the weight of the Danish side lies in the back and gammon, as compared with 54.28 per cent in the case of the English ; and only 24.92 per cent is fore-end in the Danish, as compared with 27.54 per cent in the English.

EXPERIMENTAL HUSBANDRY FARMS AND HORTICULTURE STATIONS



EXPERIMENTAL FARMS AND STATIONS OF THE N.A.A.S

(1) EXPERIMENTAL HUSBANDRY FARMS

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THE experiment has an attraction which grips the imagination of most of us. And what a wide range of investigation there is for those whose interest lies in the land—the living plant and animal, the soil, air, sunshine and rain which sustain them, and the very many raw materials which we use to get higher production ! We cannot hope that the experiment will answer all the questions we ask, even if there were adequate facilities. Experience, based on long and patient observation, must remain the key to sound farming, but even the most experienced gladly acknowledge the help they derive from research and experimental work. Indeed, recent changes in practice have shown that as production rises, further progress will depend more and more on the lead and inspiration given by that work.

Linking Research and Farm Practice

Many modern farming practices have been introduced through the experiments of farming pioneers, though their methods bore little relation to those of today. For the most part, they were contrasting cultivations, crop rotations or crop plants which were likely to throw up big differences in performance, and their findings were based on careful and prolonged observations as well as on measured yields. The more modern experimental methods have come in slowly. Perhaps the work of Mercer and Hall* at Rothamsted was one of the more powerful influences leading to this change of thought. They took what appeared to be a uniform crop of wheat and harvested one acre of it in 500 separate plots. The grain yield of the highest plot was almost double that of the lowest, and the remaining plot yields were scattered between these two extremes with a greater concentration around the mean. Even when they calculated the yields in random groups each of ten plots, the highest yield was 25 per cent greater than that of the lowest group. They had shown clearly that if it were intended to measure relatively small differences between treatments and to discuss the results with confidence, a layout should be devised to allow of the calculation of experimental error. An appreciation could then be made as to whether recorded differences were due to treatments or to some other cause. With crop experiments, this newer technique has proved its value. But we are still far from a definite answer about the methods likely to yield the best and most speedy results with certain animal experiments.

Field trials, as distinct from long-range research, now fall roughly under three heads : the simple observation study, which may confirm the need for an experiment or indicate that no further experimental work is necessary ; the demonstration, which presents to the eye the evidence of experimental work ; and the experiment proper, which involves detailed and exacting work and should therefore not be undertaken lightly. It should be laid down only after a careful review to decide whether the subject lends itself to examination by that means, and what data it will be possible to record.

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* W. B. Mercer and A. D. Hall. *J. agric. Sci.*, 1911, **4**, 107.

I have referred to types of field trials to assist in describing the actual work of the experimental husbandry farms. The proposal to set up a number of experimental farms came from the Field Experiments Committee of the Agricultural Improvement Council. The Ministry, with but little modification, accepted the advice of the Council in 1946, and since then good progress has been made under difficult conditions towards the purchase of the eighteen farms which were suggested.

A first and natural question is—why so many farms? The simple answer is—because of our many distinct farming systems. The plan was drawn up to provide facilities for the more complex observation studies and long-term experiments on farms selected on a system of husbandry basis, and representative of the more important soil types. The farms were to act as outstations of the research centres and so provide for the testing out of a new finding on a number of soil types and under a variety of climatic conditions. They were also intended to investigate the more important local problems. Where, for example, could the problems of the hill sheep farmer be tackled but on a typical hill farm?

The farms were not intended to do simple experiments and demonstrations which could be carried out on private farms, but it was made clear that they should demonstrate good farming practice and so gain the confidence of farmers to accept and adapt for their own farms those treatments or practices proved by experiment.

The farms were thus to provide a link between research on the one hand and farm practice and the simple local experiment on the other—a link whose absence was noticed during the war years, and one whose importance has been emphasized in the new farming pattern which has unfolded itself since 1945.

So far, nine of the eighteen farms have been purchased. The brief particulars which follow show the wide variations of soil and climate already covered and stress how impossible it would have been to achieve the aim in view by the provision of only one or two farms.

Cuckoo Pastures, Boxworth, near Cambridge—A heavy boulder clay farm of over 800 acres in the low rainfall belt, which covers most of East Anglia. The land is typical of much of the heavy soils of Cambridgeshire and the surrounding counties. A dairy herd of British Friesians and a flock of sheep are being built up. A pig unit is to be set up later.

Bridget's, near Winchester—A large chalk land farm of over 1,000 acres mainly on a gentle southern slope. This land is typical of much of the down lands of Dorset, Wiltshire and Hampshire. A dairy herd of Ayrshires and a flock of Cluns have been set up. It is intended to provide a poultry unit.

Gleadthorpe Grange, near Mansfield—A farm of almost 500 acres on the Bunter sand with an average rainfall of 25 inches. The farm is typical of much of the surrounding farms and of the blow-away sand land. A large poultry unit has been set up. It is hoped later to keep pigs and fattening cattle.

Great House, East Lancs—This farm covers some 390 acres of poor, thin land lying at elevations of 700–1,200 feet. Most of the land is on steep slopes and is subject to erosion under a rainfall of 55 inches. There is high and constant smoke pollution from the surrounding industrial centres. These conditions create a number of local problems which can only be tackled satisfactorily in this area. It is hoped to establish an Ayrshire herd, to keep a small flock of sheep and to build up a poultry unit.

High Mowthorpe, near Malton—A farm of over 1,000 acres on the high wolds and typical of a large area of land in East Yorkshire and North Lincolnshire. The livestock enterprises cover the breeding and rearing of pure-bred and cross-bred cattle for beef, and the breeding of sheep. A pig unit is likely to be set up shortly.

Kirton, near Boston and **Terrington, near King's Lynn**—Two farms on the silt run as one unit. Kirton is being used mainly for work on bulbs and vegetables, and Terrington for work on arable crops, especially potatoes. Pigs are kept at both centres. Fattening cattle assist to consume the by-products of the arable land and to graze the limited area of pasture. The Kirton farm is about 100 acres, and Terrington 200. The average rainfall of both farms is 22 inches.

Rosemaund, near Hereford—A farm of over 400 acres on the Old Red Sandstone, typical of much of the land in the West Midlands. The average rainfall is 24 inches. The farm grows over 40 acres of hops, which are the subject of rather intensive experimental work. The breeding and feeding of pure-bred and cross-bred cattle for beef, and the breeding of sheep are the two main livestock enterprises.

Trawscoed, near Aberystwyth—A farm of over 1,000 acres with land representative of much of the lower lying areas in North Wales. There is a hill rising to 1,000 feet which carries a flock of Welsh Mountain ewes. On the lower land a Dairy Shorthorn herd is being built up. A herd of pedigree Welsh pigs has been established.

An agreement has been made for the Norfolk Agricultural Station at Sprowston to assist in the experimental programme, and so there is no proposal to look for a light land farm in East Anglia. The work of Sprowston is very well known not only in Norfolk but throughout the country, and indeed, the Field Experiments Committee had that station very much in mind in framing their advice for the purchase of experimental farms. It is fortunate, too, that Mr. F. Rayns, who has been its Director for many years, should be guiding the deliberations of the Experimental Husbandry Committee which now advises the Ministry on the purchase of suitable farms and generally on experimental programmes.

The probable locations of the farms still to be acquired are : Devon and Northumberland (cultivable uplands), East Anglia (black fen), Gloucester (oölitic limestone), Somerset and Warwicks (clay), Yorks (medium soil, Vale of York) and Wales (a hill farm).

Each farm is under the charge of a farm director—an N.A.A.S. officer, who can call on a Farm Advisory Committee to advise him on day-to-day management problems. He has a small staff of technical and executive officers to assist in the experimental work and the farm records.

As stated earlier, the Ministry is advised on the experimental programme for each farm by the Experimental Husbandry Committee of the Agricultural Improvement Council, which reviews all requests for experimental facilities from whatever source they may come. It has proved most helpful to have the advice of farmers, research workers, teachers and advisers on that committee and its sub-committees. The proposals for experimental work are so many and varied and the facilities so limited, that a central body to receive all requests and to advise on priorities has been shown to be essential.

Development still in Initial Stages I have written of a new venture—often discussed but only lately embarked upon. We are still in the early stages of development. On some of the farms much preliminary work has been necessary, e.g., draining and cleaning of land, adjustments to field boundaries, laying-on of water, adaptation of existing buildings or provision of new buildings for experiments, and provision of cottages. We have had to restrict the experimental programme according to the progress of that work, but generally there has been no serious hold-up. No one will question the importance of materials, but the success of the experimental work must rest mainly on the team work of technical staffs and farm workers. The enthusiasm of the Farm Directors who are endeavouring to build up such teams, has already taken them over many hurdles. I am sure they would wish to express their appreciation of the help they have received from their Farm Advisory Committees, staff and workers. Already much useful experimental work is in progress, which it is hoped to describe in a later issue of this JOURNAL.

(2) EXPERIMENTAL HORTICULTURE STATIONS

C. E. HUDSON, N.D.H.
National Agricultural Advisory Service

THE choice of sites for the experimental horticulture stations has, of course, been governed by similar considerations to those applying to the experimental husbandry farms. At present, including the National Fruit Trials, six N.A.A.S. experimental horticulture stations are planned, together with a certain number of sub-stations. Three small demonstration stations are also being established in Wales. Sites for all the main stations have been acquired, except that in East Anglia.

Rosewarne Farm, Camborne, Cornwall—About 100 acres, almost frost-free, with a south-west Atlantic coast climate and a rainfall of 40 inches. It is concerned primarily with the study of such early spring vegetables, flowers and bulbs as are produced in Cornwall and the Isles of Scilly. The station will be associated with the vegetable, and the glasshouse and flower research stations.

It is proposed that the small station at ELLBRIDGE of some 4 acres should be used as a sub-station to investigate local problems associated with the Tamar Valley and similar areas in the district. The work of the Gulval Station has been transferred to Rosewarne, and the station closed down in September 1952.

Luddington Manor Farm, near Stratford-on-Avon, Warwicks, with an area of 230 acres and a rainfall of 25 inches, was taken over in September 1949, mainly for fruit, vegetables and crops in frames. This is one of the main stations and is typical of the land in Worcestershire and the Vale of Evesham.

Stockbridge House Farm, near Selby, Yorks, with an area of 165 acres and a rainfall of 22 inches, was acquired in May 1950 to cover the Yorkshire and Lancashire area, and is to be used primarily for investigations on vegetables, rhubarb and soft fruit crops and the cultivation of crops under Dutch lights and cloches. It is proposed to erect up to 4 acres of Dutch lights as "structures", movable houses and "flat" glass. The farm is on the edge of the industrial pollution area, with a soil typical of much of the plain of York.

Right : *Experimental Horticulture Station, Luddington*

Sow badger calling out her cubs

Photos : *F. Howard Lancum*

The cub that wouldn't go home !

Earth, stones and old bedding thrown out of a sett by badgers

Photos : *F. Howard Lancum*

Path worn by generations of badgers

WINTERING STORE CATTLE : COCKLE PARK TRIAL, 1951-52 (See pp. 428–35)

Eighteen-months-old Shorthorn stirks at Cockle Park

Photo : *Newcastle Chronicle and Journal Ltd.*

The glasshouse sub-station in Lancashire, FAIRFIELD HOUSE FARM, with about 20 acres of land and a rainfall of 35 inches, was taken over in April 1950, for the cultivation of glasshouse crops, flowers and some soft fruit. This station will also be used for the time being to serve the requirements of the West Midland area for investigations on these crops. It is proposed to erect up to 4 acres of glasshouses of various types other than Dutch lights.

Efford Farm, Lymington, Hants, with an area of 307 acres and a rainfall of 28 inches, was taken over in June 1951, for the cultivation of fruit, vegetables, glasshouse crops and flowers. Situated in a very good light area, fairly exposed to the sea and typical of many of the areas used for horticultural crops on the south coast, this farm is taking the place of the previous farm at Titchfield, which had to be given up as a result of other developments in the district outside the Ministry's control. It will be one of the main stations. The work of the small station at Botley is being transferred to Efford and to experimental plots in Hampshire, and the station closed down in September 1952.

East Anglia—To complete the plan for a chain of horticultural stations, a holding of 200–250 acres is to be purchased in East Anglia for fruit, vegetables, glasshouse crops and flowers. Owing to the exceptional soil conditions in the Isle of Ely and Wisbech districts, it is necessary to have a small sub-station in that area mainly for investigations on fruit.

Fruit Variety Testing Station—A site has been acquired in Kent to which the National Fruit Trials will be transferred gradually and which will be under the auspices of the N.A.A.S.. The Royal Horticultural Society has been asked to continue the Fruit Trials at Wisley for the time being.

Horticulture at Husbandry Farms In Lincolnshire (Holland) at Kirton Experimental Husbandry Farm, the experimental work on bulbs and vegetables is being continued and extended with the provision of additional buildings and equipment. The glasshouses at Terrington Experimental Farm are also being used for horticultural experimental work.

In Herefordshire, a part of Rosemaund Husbandry Farm is being used for experimental work on hops, and it is hoped to find a site nearby for cider fruit. Approximately one-third of the hops grown in the country are in the West Midland area. Owing to the higher rainfall and different soil and climatic conditions of Herefordshire as compared with Kent, it is necessary to carry out a series of experiments on varieties, methods of planting, manuring and cultivation generally. As this is an important county for the production of cider fruit, some 40 acres of experimental cider orchards are to be planted in order to ascertain the most suitable varieties, types of trees and the times of flowering, together with other investigations.

Demonstration Stations in Wales Three stations are being established in Wales ; one of about 30 acres at Bangor, one of 15 acres on the Husbandry Farm at Trawscoed, Aberystwyth, and one of 70 acres at Cleppa Park, Newport (Mon). At first, these will be used mainly for demonstration purposes. Advantage is being taken of the exceptional isolated character of this area of Wales to demonstrate and undertake at Trawscoed the propagation of healthy stocks of certain soft fruits.

Management of the N.A.A.S. Stations It is essential that the stations should be well managed and, with this in mind, a senior horticultural officer has been made Director of each station. Technical and recording staff are being appointed as required. The larger stations have provision for the keeping of stock, so that farmyard manure can be made and experiments included on vegetables in a farm rotation. This necessarily involves the proper management of leys for which stock is also necessary.

There will be local advisory committees for each station. The committees comprise the Directors of the research stations mainly concerned (or their representatives), local growers and representatives from the N.A.A.S. Normally, the chairman is chosen from among prominent members of the industry, and the Provincial Director or his deputy acts as vice-chairman. The local advisory committee assists the station director in the general management of the station and the general conduct of the experimental work, and draws attention to any local problems of particular interest or concern which require investigation.

Proposals for experimental work at the station can come from a variety of sources. Normally, the main source of proposals is from the research stations, through the Agricultural Research Council. Each province of the N.A.A.S. has an experiments committee to co-ordinate and plan the experiments in the area, and these committees also put forward suggestions for experiments on the stations. The experiments promulgated in this way are frequently of a type which have some special local significance. The Directors of the stations and the station advisory committees also make suggestions for investigations. Other requests may come from growers or growers' organizations, or indeed from any interested source inside or outside the N.A.A.S.

A.I.C. Experimental Horticulture Committee All proposals for investigational work at the stations are duly considered by a committee of the Agricultural Improvement Council, known as the Experimental Horticulture Committee, under the chairmanship of Dr. H. V. Taylor. The main function of this committee is to keep the whole field of experimental work in perspective and to plan the broad outline of the experimental programme. The Committee also receives reports on the conduct of investigational work within its purview.

Very close collaboration is maintained with the horticultural and other research stations, and working parties have been appointed, representing the research stations, the National Fruit Trials and the Provincial N.A.A.S. advisers and others, to prepare an outline programme for experimental work over the next ten to fifteen years. This programme was necessary so that adequate facilities might be provided for the various aspects of the work.

EXPERIMENTAL FARMS AND STATIONS AND THEIR PRESENT DIRECTORS

Experimental Husbandry Farm	Director
Bridget's Farm, Martyr Worthy, nr. Winchester, Hants	W. D. Hay, O.B.E., B.Sc. (Agric.)
Cuckoo Pastures Farm, Boxworth, Cambs	E. T. Sykes, M.A.
Gleadthorpe Farm, Welbeck Colliery Village, near Mansfield, Notts	S. Culpin, M.Sc., N.D.A.
Great House Farm, Helmshore, Rossendale, Lancs	C. H. Mudd, B.Sc.
High Mowthorpe Farm, Duggleby, near Malton, Yorks	J. T. R. Lockwood, N.D.A., N.D.D.
Rosemaund Farm, Preston Wynne, near Hereford	E. L. Jones, M.Sc., N.D.A.
Terrington Farm, Terrington St. Clement, near King's Lynn, Norfolk, and Kirton Farm, Boston, Lincs	A. C. Owers, M.A., Dip. Agric.
Trawscoed Farm, Aberystwyth, Cards	W. M. R. Evans, M.Sc.

EXPERIMENTAL FARMS AND STATIONS OF THE N.A.A.S.

Experimental Horticulture Stations	Director
Efford Farm, Lymington, Hants	P. H. Brown, N.D.H.
Fairfield Farm, Esprick, near Kirkham, Lancs	G. F. Sheard, M.Sc.
Luddington Manor Farm, near Stratford-on-Avon, Warwicks	H. Fairbank, N.D.H.
Rosewarne Farm, Camborne, Cornwall	F. W. Shepherd, N.D.H.
Stockbridge House Farm, Cawood, Selby, Yorks	F. G. Smith, N.D.H.
National Fruit Trials, Faversham, Kent	J. M. S. Potter, N.D.H.

A map showing the locations of these farms and stations appears on page 420.

AGRICULTURAL INDEX NUMBERS AND PRICES

MONTHLY INDEX NUMBERS AND PRICES OF AGRICULTURAL PRODUCTS

INCLUDING EXCHEQUER PAYMENTS (UNCORRECTED FOR SEASONAL VARIATION)

BASE 1927-29=100

	Unit	Prices used for Sept. 1952 Index	1952			1951		
			July	Aug.	Sept.	July	Aug.	Sept.
All Products ..	—	—	244*	265*	279*	243	258	272
Cereals and Farm Crops ..	—	—	236	254	238	275	264	259
Livestock and Livestock Pr'd'ts	—	—	246*	268*	293*	232	256	276
		s. d.						
Wheat	cwt.	27 6	266	266	266	260	260	260
Barley	,,	30 8	273	294	279	332	384	412
Oats	,,	25 2	284	272	272	295	291	289
Potatoes ..	ton	204 6	202	232	203	261	217	194
Hay	—	—	174	174	177	231	220	225
Fat cattle ..	live cwt.	122 7	267	259	249	246	240	229
Fat cows ..	,, ,,	73 2	223	221	208	217	214	201
Fat sheep ..	lb. d.w.	2 4¼	233	233	224	222	222	212
Fat ewes ..	,, ,,	1 5½	215	212	212	200	197	197
Bacon pigs ..	score	55 5*	360	363	363*	345	346	346
Pork pigs ..	(20 lb.)	50 6	306	301	299	296	296	296
Sows	d.w.	27 5	248	241	238	235	235	235
Milk	gallon	3 5.3*	230*	275*	318*	212	254	295
Butter	12 lb.	30 0	143	143	143	143	143	143
Poultry	—	—	271	265	254	273	266	262
Eggs	120	50 6	246	248	278	248	268	275
		£ s. d.						
Store Stock† ..								
Dairy cows ..	head	58 0 0	202	207	214	180	185	189
Store cattle ..	,,	38 2 0	262	260	262	227	222	218
Store sheep ..	,,	6 4 0	252	240	229	235	223	221
Store pigs ..	,,	8 15 6	458	457	466	441	423	394

* Provisional

† Not included in general index

WINTERING STORE CATTLE

COCKLE PARK TRIAL, 1951-52

PROFESSOR H. C. PAWSON, M.B.E., M.Sc., F.R.S.E.
and
G. A. BLACKETT, M.Sc.
King's College, Newcastle-upon-Tyne

Reports of the earlier trials at Cockle Park on the wintering of store cattle appeared in the November 1948, January 1950, January 1951 and December 1951 issues of AGRICULTURE. The conditions of this latest trial were in all respects similar to those carried out in the previous four years.

FOR the fifth year in succession winter feeding trials were carried out at Cockle Park with young beef store cattle born the previous spring. The animals were from the breeding herd of attested beef Shorthorns from the same dams and by the pedigree Shorthorn bull (Cruggleton Burke) and reared in the same manner as in previous years.

The feeding trial for 1951–52 compared, as in previous years, the outwintering and inwintering of bullock stirks, but in the case of the inwintered heifer stirks, the trial was reduced from three to two lots, these being fed entirely on home-grown foods. The main object of the trial with the heifer stirks, which must be considered as rather exploratory in nature, was to test one group fed on grass silage to "appetite capacity" with another lot fed on a ration comprising hay, swedes, beans and oats.

In the previous report* reference was made to the fact that heifer stirks receiving a daily ration of grass silage with 10 lb. of hay and 1½ lb. of oats, apparently would not consume more than 20 lb. per head per day of the former feed. The disappointing liveweight increases from silage fed in this way, when compared with rations containing linseed cake and oats, and beans and oats, were criticized on the ground that the silage-fed lot were not receiving as much starch equivalent in their ration as that given to the other lots, although all three lots received the same quantities of hay and oats. Every attempt was made to encourage the silage-fed stirks to consume more of the silage, but without success. Reference was also made in last year's report to the higher fibre content and rather lower starch value in the silage ration, and it was indicated that, for the winter of 1951–52, it was the intention to exclude the hay and oats from the ration of the silage group, and feed instead a maximum allowance of grass silage.

As in the previous year, nine bullocks were outwintered and nine wintered indoors, but in the case of the heifer stirks the number in each lot was reduced from seven to five because of the smaller number available for selection this season. All were single, suckled calves weaned in October.

Analyses of Feeds Used in the Trial All feeds used in the trial were grown at Cockle Park. Two distinct types of silage were fed during the experiment. For the first period, silage conserved with molasses in a surface silo—which was the product of part of the aftermath of the ley from which the hay crop used in the trial was taken—was fed to the heifer stirks. For the latter part of the trial, silage from a trench silo (the same silo as used for previous trials), and made from the herbage of a two-year-old ley cut at the pre-hay stage, was used.

* Published in the December 1951 issue of this JOURNAL, pp. 413-7.

Silage from the surface silo gave the following analysis :

	Percentage of Fresh Material	Percentage of Dried Sample
Moisture	85.5	—
Crude protein	—	17.6
Crude fibre	—	31.2
Digestible crude protein	1.7	11.7
Estimated starch equivalent	6.4	44.0
	*p*H — 4.7	

The *p*H figure reveals that the degree of fermentation was not ideal, giving rise to an underheated type of silage. In actual fact, the degree of fermentation was variable, resulting in stratification of silage types within the silo. There had been a tendency to over-consolidate the herbage ensiled at the lower depth, producing a strong-smelling butyric silage, while that of the upper layers was of the light-brown acid type.

A representative sample of silage taken from the trench silo was analysed by the N.A.A.S. and reported on as follows :

	Percentage of Fresh Material	Percentage of Dried Sample
Moisture	80.3	—
Crude protein	2.9	14.6
Crude fibre	5.4	27.5
Digestible crude protein	2.4	12.1
Estimated starch equivalent ..	10.6	54.0
	*p*H — 3.9	

The N.A.A.S. Nutrition Chemist, in his report, classified this silage in the high protein category because of the high protein digestibility (approximately 83 per cent). Fermentation was excellent, the silage being of the green fruity type.

No precaution was taken in either case to exclude rain water from the silo. Experience with the trench silo in previous years did not altogether support the need for covering the ensiled material with soil for this purpose. Nevertheless, following the exceptional rainfall in the month of November 1951 (6.88 inches recorded), rain-water seepage had encouraged silage putrefaction in the upper layers and along the sides of both containers. This feature is of some practical importance and emphasizes the need for a suitable cover and/or heaping the ensiled material sufficiently high above surface level to ensure that, after settling, rain-water will flow away from, rather than into, the silo. The contents of the concrete-lined surface silo suffered greater material loss, since rain-water shed off to the edges, being unable to pass through the walls, gradually seeped down the sides and encouraged further silage putrefaction.

The hay fed to the heifers in Lot 4 was made from the first-year growth of a Cockle Park-type seeds mixture designed for a 3-year ley. Cut and baled in early July, the hay contained a fair proportion of clover and had a good, green colour. Analysis of a sample, examined by the N.A.A.S. Nutrition Chemist at Newcastle, was :

	per cent
Moisture	13.6
Crude protein*	10.2
Crude fibre	29.3
Nitrogen—free extractives	38.9

* *Includes*: digestible crude protein – 6.7 per cent; estimated starch equivalent – 33 per cent.

With 11.8 per cent crude protein in the dry matter, the product may be classified as good quality seeds hay.

Caledonian swedes were fed to Lots 2 (inwintered bullocks) and 4 (inwintered heifers) throughout the feeding trial. Analysed by the N.A.A.S. in January 1952, the swedes showed the following make-up for the main food constituents :

	Percentage of Fresh Material	Percentage of Dried Sample
Moisture	89.2	—
Crude protein	—	9.1
Crude fibre	—	10.5
Digestible crude protein	—	7.1
Estimated starch equivalent	—	64.0

It may be noted that the dry matter content of the swedes was below average (average for Cockle Park = 12 per cent). This result is significant in view of their rather poor keeping quality towards the end of the trial.

No actual chemical determinations were made on the beans and oats. The nutritive values given in the Ministry of Agriculture Bulletin No. 124, *The Composition and Nutritive Value of Feedingstuffs*, now incorporated in Bulletin No. 48, *Rations for Livestock*, were accepted for rationing purposes.

Composition of Rations For the first sixty-five days of the trial, aftermath silage, which had been made in the surface silo, was fed to the five heifer stirks in Lot 3. For the remaining seventy-six days, silage was used from the trench silo. During the period when aftermath silage (surface silo) was available, the average amount consumed was 70.8 lb. per head per day. The actual amount consumed per day ranged from 54 lb., which was the total quantity cleared up at the beginning of the trial, to a peak figure of 87.5 lb. towards the end of the period. Accepting the figure of 70.8 lb. as representing the daily quantity of aftermath silage consumed, the nutrients supplied in the ration would be :

	lb.
Dry matter	10.266
Digestible crude protein	1.201
Crude fibre	3.203
Starch equivalent	4.517

In this instance, the digestible crude protein/starch equivalent ratio was about 1 : 4.

The amount of leafy "seeds" silage (trench silo) consumed per head per day ranged from 50 to 75 lb., the average figure for the period being 66.4 lb. Using the latter figure as a basis for determining the quantity of different constituents supplied, the final computation worked out as follows :

	lb.
Dry matter	12.338
Digestible crude protein	1.493
Crude fibre	3.393
Starch equivalent	6.662

The ratio of digestible crude protein to starch equivalent was 1 : 4½.

The ration per head per day for Lot 4 stirks consisted of 10 lb. each of hay and swedes and 1½ lb. each of beans and oats. This ration would provide the following quantity of nutrients :

	lb.
Dry matter	12.305
Digestible crude protein	1.166
Crude fibre	3.303
Starch equivalent	5.871

The ratio of digestible crude protein to starch equivalent was thus 1 : 5.

A proprietary mineral mixture was offered to both lots of stirks throughout the experiment.

Conduct of the Trial The preliminary feeding period extended to twelve days. At the beginning, each group of stirks was showing some loss of condition following weaning and a period of feeding on hay alone.

During the preliminary period, silage was introduced gradually to Lot 3 stirks, and increased until they were cleaning up 54 lb. per head per day. Three feeds a day were given—the first at 7 o'clock, the second at midday, and the third in the early evening. At the start of the trial, 54 lb. was the maximum quantity cleared per head per day, but as the stirks became accustomed to the aftermath silage, the amount eaten increased appreciably from day to day, reaching a peak figure of 87.5 lb. per head per day sixty-one days after the beginning of the trial proper.

The change-over from the aftermath silage to the leafy "seeds" silage was made five days after the peak figure was attained, and, incidentally, served as a check to the cattle. Within three days of the change-over, silage consumption had fallen to 75 lb. per head per day. In a week, consumption had fallen to 50 lb., but it subsequently increased steadily, reaching a maximum of 72.5 lb. after thirty-six days on the "seeds" silage. Thenceforward the allowance was reduced gradually until the amount consumed totalled 65 lb. per head per day. This latter figure for the amount of silage eaten was maintained until the end of the experiment.

Discussion of Main Results In the preliminary feeding period the silage group suffered an average loss of 0.5 lb. per head per day. Unlike the silage group, the Lot 4 heifers, which were introduced to the trial ration given in Table 1, suffered no setback, but actually gained an average of 1 lb. per head per day.

This result is interesting in that it shows that the cattle introduced to strong-smelling aftermath silage needed time to accustom themselves to such a diet, as evidenced by their inability to maintain their weight. By comparison, the lot on hay, swedes, beans and oats settled quickly to the ration and began to gain weight.

It will be noted that the supply of aftermath silage gave out after sixty-five days. No weights were recorded for the silage beasts at this particular time, but the average liveweight increase for the first fifty-seven days was 1.34 lb. per head per day. For the same period, the oats and beans group gained 1.14 lb. per head per day.

An examination of the monthly weighing data shows that in the month of February, when the stirks suffered the setback from the silage ration change, the average liveweight increase of the silage-fed group fell to 0.8 lb. per head per day. It was not until towards the end of the month that the cattle adjusted themselves to the new diet. For the remaining fifty-seven days of the trial the silage stirks improved markedly and maintained an average liveweight increase of 1.5 lb. per head per day (the oats and beans group gained 0.95 lb. per head per day in the same period).

Table 1

HEIFERS

Wintered Inside, 1951-52

	Ear Mark	Weight December 11	Weight Gain or Loss at Jan. 8	Weight Gain or Loss at Feb. 5	Weight Gain or Loss at Mar. 4	Weight Gain or Loss at April 1	Weight Gain or Loss at April 29	Final Weight April 29	Average Weight Increase per Head
LOT 3 **5 Heifers**		*cwt. qr. lb.*	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*	*cwt. qr. lb.*	*lb.*
RATION PER HEAD PER DAY	5	3 3 14	29	51	27	38	51	5 2 14	
	10	4 1 18	38	36	20	28	72	6 0 16	
	7	4 1 0	40	24	12	55	6	5 1 25	186.6
Grass silage to capacity (see text)	16	4 1 0	47	34	44	29	42	6 0 0	
	19	4 0 12	48	36	16	56	54	5 3 26	
LOT 4 **5 Heifers**									
RATION PER HEAD PER DAY	29	4 2 25	14	28	45	37	27	6 0 8	
	17	4 1 9	57	32	22	37	16	5 3 5	
lb.	27	3 3 7	49	28	28	15	33	5 0 20	143.6
Hay 10	35	4 0 27	51	19	9	25	32	5 1 23	
Roots 10	38	3 3 19	18	28	19	20	29	4 3 21	
Beans 1½									
Oats 1½									

The average liveweight increase of the silage group for the whole experimental period was 1.32 lb. per head per day, compared with 1.02 lb. for the oats and beans group.

It was the general opinion on inspection of the cattle that liveweight gain of the silage group was more closely associated with skeletal growth rather than fat deposition. This view was supported by the independent valuer when the two lots were valued in April 1952. Examination of both groups at the end of the trial showed the silage lot to be of larger frame and carrying more hair than the Lot 4 heifers. A feature of the silage group was their improving condition towards the close of the experiment—a result which was confirmed by the liveweight gains at this period (Table 1).

Skeletal growth was more limited in the oats and beans group, resulting in a blockier type of animal, which lacked a little in height and length but possessed good width and depth. There was evidence of some fat deposition.

The different emphasis in liveweight gain of the two lots of cattle may possibly be connected with the digestible crude protein/starch equivalent ratio of the two test rations. Since the silage group had a higher intake of protein, it is feasible to assume that this would promote frame growth rather than fat.

With regard to actual feeding, it may be noted that it was necessary to offer silage three times daily to ensure that Lot 3 cleared up a suitable quantity. A feature of the silage lot was their habit of "staggering" feeding between silage replenishments, except for the morning feed, which followed the longest interval.

General Observations The keeping quality of the two feeds, swedes and silage, were observed. While the silage quality was maintained to the end of the experiment, that of the roots deteriorated notably in the last month of the trial. This feature is of some importance, particularly in a season of late spring grass growth (not uncommon at Cockle Park), when an extended period of feeding on winter rations may be necessary.

A difference in temperament of the two lots of stirks throughout the trial was observed by those concerned with their day-to-day management. While those of Lot 4 were docile and easy to handle, the silage group were more restless and fractious, and although it is recognized that this observation relates only to one trial, the difference seemed to justify mention in the report. One managerial feature of interest was the different demands made by the two lots of cattle for bedding. The silage lot needed about twice the amount of litter required by the oats and beans group to maintain dry conditions underfoot.

The progress of the two groups of heifers (Lots 3 and 4) on pasture has been measured during the summer of 1952. Up-to-date results have not confirmed the opinion of some silage feeders that cattle wintered on silage make greater progress when turned out to grass the following spring than do cattle wintered on rations of hay and roots, etc.

Outwintered versus Inwintered The liveweight increases for the outwintered and inwintered bullocks are recorded in Table 2 (p. 434). The performance of the outwintered bullocks is outstanding when compared with the results obtained from the past four winters. Weather conditions were, on the whole, favourable to outwintering stock. Except for a period in the latter half of January and early February, when conditions were generally cold, with keen frost and occasional snow, and

Table 2

BULLOCKS

Wintered Outside v. Wintered Inside, 1951-52

LOT 1 9 Bullocks (Wintered Out)		Ear Mark	Weight December 11	Weight Gain or Loss at Jan. 8	Weight Gain or Loss at Feb. 5	Weight Gain or Loss at Mar. 4	Weight Gain or Loss at April 1	Weight Gain or Loss at April 29	Final Weight April 29	Average Weight Increase per Head
			cwt. qr. lb.	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*	*cwt. qr. lb.*	*lb.*
RATION PER HEAD		24	4 1 0	28	36	48	0	61	5 3 5	
PER DAY		31	4 2 11	27	41	14	-9	71	5 3 15	
	lb.	23	4 3 22	32	38	16	18	24	6 0 10	
Hay	12	4	4 2 25	31	32	11	1	58	5 3 18	
Oats	1½	39	4 1 6	47	39	-24	30	59	5 2 17	142
Linseed cake	1½	26	3 2 16	39	50	11	8	44	5 0 0	
		21	4 2 15	37	62	15	2	32	5 3 21	
		11	4 1 26	30	23	20	-2	18	5 1 3	
		8	4 3 22	18	57	24	11	50	6 1 14	
LOT 2 **9 Bullocks** **(Wintered Inside)**		6	4 1 19	65	28	22	62	31	6 1 3	
		18	3 3 0	45	27	27	30	11	5 0 0	
		9	4 3 10	59	27	44	28	29	6 2 1	
RATION PER HEAD		2	5 0 18	52	48	50	0	54	6 3 26	
PER DAY	*lb.*	36	4 3 22	17	21	15	9	6	5 2 6	170.2
Hay	12	42	4 0 0	44	19	9	45	30	5 1 7	
Roots	10	25	5 0 16	40	50	12	50	37	6 3 9	
Oats	1½	15	4 0 6	66	40	38	18	41	5 3 13	
Linseed cake	1½	33	3 3 10	40	47	23	20	56	5 2 0	

the cold and wintry conditions experienced in the latter part of March, rather dry and mild weather prevailed.

With the growth of grass in very early spring, and slight deterioration in the hay, it was noticeable that the outwintered bullocks were reluctant to clear up the hay ration. This factor may partly account for the poorer liveweight gains made in the month of March, since the amount of herbage was insufficient to support the cattle.

A comparison of the spring valuation figures over the five-year period, 1948–52, for the two groups of bullocks, reveals that the outwintered bullocks averaged just over 30s. per head more than the inwintered lot, despite the heavier aggregate weight of the latter each spring.

The writers wish to acknowledge their appreciation of the valuable assistance given by Mr. P. P. Brennan, B.Sc., Record Keeper, Major J. H. Murray, Farm Manager, and Mr. S. Pile, Assistant Stockman, in the conduct of the trial.

HOME LIFE OF THE BADGER

F. Howard Lancum, M.B.E., F.L.S.

The tireless vigil required of a field naturalist in the pursuit of first-hand evidence is well shown in this article by the author of the Ministry's bulletin, *Wild Mammals and the Land.*

OF all our British wild mammals, the badger is, to me, the most interesting and likeable, and, in common with many other naturalists, I have often wondered at its treatment at the hand of man. Here, one would say, is an animal well worthy of man's respect and admiration ; clean in its personal and domestic habits, inoffensive, unobtrusive, and possessed of a courage unsurpassed in the animal kingdom. Further, of all our native wild mammals, it is probably the most useful to the farmer. Yet in many, if not in most, parts of the country it is persecuted on evidence that is so flimsy as to be almost negligible.

Perhaps one badger in ten thousand turns "rogue" and kills a fowl, and usually a proven case of this kind is the signal for stepping-up a local offensive against the badger population generally. While few would question the justice of inflicting summary punishment on the actual offender, the wholesale condemnation of a species on the strength of an exceptional individual misdeed has in it neither justice nor common sense. The fox may make serious and repeated inroads on the poultry farmer's stock without incurring a tithe of the odium which attaches to a badger suffering a lapse from grace, and the contrast between the average countryman's attitude to the two animals is difficult to understand.

It may be that one of the main causes, if not the root cause, of the trouble is the widespread ignorance of the badger's habits and true character. Recently, I talked with a badger-digger who had been described to me as the local arch-exponent of his peculiar craft. He, with others, had been digging out badgers for a quarter of a century, but, on his own admission, he had never watched a live badger apart from those he had unearthed for slaughter.

The life history of the animal was a closed book to him, except that he had acquired the knowledge that, if need be, it will fight to the death.

However, a defence of the badger is not the purpose of this article, much as I should like to undertake it once again and to detail the mass of favourable evidence that I have gathered during the last forty years. I write now in the hope that some information on the home life of this fine animal may be acceptable to those readers of this JOURNAL (and they are many) who are interested in natural history in general and the badger in particular.

Watching at the Sett This year, finding myself with more leisure than ever before, I have taken the opportunity of improving my knowledge of the badger. Apart from my great liking for the animal, it is a pleasant thing to sit in the woods after dark, listening to the sounds of the night creatures. Between the beginning of May and the end of July I spent, in all, twenty-seven nights watching and photographing a local colony of badgers at close quarters. To do this it is necessary to use great care not only in your approach to and movements while at a sett, but, if you wish to continue to watch it with profit, in your departure from the scene also. Then the observer must curb his zeal for photography, tempting though many shots may be, for as a rule it is a case of one night, one photograph, with the flash-bulb putting an end to his opportunities.

The badger is a very wary creature. Although its sight is not especially good, its hearing is very keen, but the sense on which, above all others, it relies is that of smell. As an example of this, one warm, humid day in May, at 3.30 p.m. (B.S.T.) I pressed the palm of my hand hard down on a badger path leading from the sett, leaving my hand there for one minute. At ten o'clock the same evening a badger emerged from the sett and followed the path until it reached the place where my hand had been. There it halted, took one sniff, shied like a startled horse and incontinently bolted underground. It is noteworthy that by 12.30 a.m., when I left the sett, neither this nor any other badger had as much as shown a nose.

It will be apparent that the one thing to which the would-be watcher must pay careful attention is the direction of the prevailing wind, and it is my custom to dispose a number of "hides" around the chosen sett, using any of these at need according to the wind. The quickness with which a badger can pick up an alien scent in the wind is remarkable, and any such scent, especially if it is human, may well wreck one's chances of observation for the night. On the other hand, with the wind right I have known a badger to pass within two yards of me without detecting my presence.

The sett which I have been watching is situated in a rather remote wood on the edge of a moor. It is a small sett with nine entrance holes, all of which can be kept in view at one time. The total badger population of this sett is seven—one pair with three cubs and another pair of adults which, I think, have somehow lost their cubs. Of the seven other setts I know in the district, six, like this one, are in woodland, and all are on sloping ground. These things are characteristic. One of these local setts must be among the largest in the country, covering nearly an acre of ground and having more than a hundred entrance holes. It is a very remarkable sett indeed, but is much too large for effective observation.

In the spring and summer months, I usually take up my position in the hide well before sunset, for although it is broadly true that at these seasons one may expect the first badger to emerge from a sett within an hour *after* sunset, this is, at best, a generalization to which there are many exceptions.

Much depends on what has happened on previous evenings. Badgers that have been seriously alarmed or disturbed on, say, Monday evening, may emerge on Tuesday and even Wednesday much later than usual, and on the Tuesday, indeed, they may not come out at all. The nights of July 13 and 14 this year in my district were both fine and dry, and, one would have thought, ideal for the badgers. I did not visit the sett on the 13th, but I was there on the evening of the 14th from 7.30 to 11.45 p.m. During that time, I neither saw nor heard a badger, and I can only assume that something disturbing had occurred on the previous day.

On the other hand, if the weather on one night is wild and stormy, and the badgers are disinclined to move or are unable completely to satisfy their hunger, they may be out much earlier than usual the next evening. In my district, June 22 of this year was just such a night, with a high wind and driving rain; and although I watched from early evening until dawn of the following day, no badger showed at all. During the morning of June 23, however, the weather changed and the rest of the day was fine and sunny. I had a sleep and returned to the sett that evening, and the first badger appeared at 8.55 p.m., although sunset was not until 9.20. All the inhabitants of the sett were, in fact, out of it well before dark. It will thus be seen that the watcher can never be sure of the time of emergence on any given evening. In late autumn and winter, badgers normally do not move until some considerable time after sunset. This is understandable, since they have long hours of darkness before them and ample time to procure food before daybreak.

Family Life It is my experience that, in spring and early summer, the first member of a badger family to leave the sett is the old boar, followed after an interval by the sow and the cubs. There are, however, exceptions to this rule also, for on several occasions I have seen a whole family emerge in close procession, and not infrequently the cubs try to get out before either of their parents. Once, I was much amused to see an old sow bustle out of the sett after the three small, over-eager cubs, cuff them all soundly and marshal them back to earth ! I was surprised to see that the sow did not bite or pretend to bite her offspring ; she literally cuffed them with a forepaw. In late summer, when the cubs are well grown and strong and are left to fend more or less for themselves, they frequently come out independently of their parents and, as often, much earlier than the latter. At my favourite sett the three cubs, in late June and early July, were often running about before sunset. Of these cubs, one was persistently " late on parade". Two of the cubs would emerge almost together and take the path out of the sett. A minute or two later, the laggard would appear, look about to get its bearings, and then break into a hand gallop to catch up the others.

The first thing that an adult or well-grown young badger does on reaching an exit of a sett is to sniff about it well on all sides. I have seen scores of badgers come out of different setts, but never one that omitted this precaution. Most of them take another sniff on reaching the open and before leaving the sett altogether. Badgers take nothing on chance.

While there are cubs in a sett much time is given to play, and except for the otter I know of no wild animal that plays with such zest and apparent enjoyment. One still, windless night in May, I had a whole badger family joining in a kind of game of "tag" all round my hide. The cubs, especially, seem very fond of this, and, in addition, they engage in mock battles and a game, very like leap-frog, that is most amusing to watch.

Mistaken Ideas about the Badger The popular notion of the badger as a noisy, clumsy, slow-moving beast is far from the truth. It is true that while playing or foraging for food it does make a good deal of noise, but when leaving or entering a sett, or when on its way to some definite objective, its movements can be as quick, lithe and silent as those of a cat. I once watched an old boar badger come out, sniff the air for a minute or two in the usual way, and then make a complete tour of the environs of the sett. Although my hearing is fairly good and although I listened carefully, I could hardly detect a sound.

Equally mistaken is the idea that the only vocal noise the badger makes is a grunt. In fact, it makes a variety of interesting and characteristic noises. There is the boar's weird, unearthly screech, sometimes heard in late autumn, the peculiar "wickering" noise of the sow when calling out her cubs, and her crooning growl restraining them when they are inclined to venture out too early. While at play, badgers, old and young, growl rather like dogs in, I think, simulated anger, and sometimes indulge in a staccato chattering after the manner of a stoat. They have a very human-like sneeze, and when examining food they make curious, breathy, gobbling noises. They have a kind of whining moan, not unlike that of a cat, which seems to be both an indication of real anger and a warning. I have only heard this noise on two occasions, the latter of which (May 11) was a memorable one for me. I had long been convinced that badgers do sometimes evict foxes which have ambitions to share their setts, but this was the first time I actually witnessed such an occurrence. The fox came out of the sett in a great hurry, followed by an irate sow badger. It was noticeable that, apart from a snarl and one backward look, the fox showed no sign of contesting the issue, and indeed it was obvious that it was very willing to leave the badger in possession. I do not think it ever reappeared at the sett ; at least, I never saw it there again although I watched the place for a long time afterwards.

One of the most pleasing badger noises is the excited yelp of a cub when playing ; and what to me is very amusing and attractive is a cub's habit of letting out a single yelp of joy or excitement at finding something particularly good to eat. One night in late May I heard this sound, from various points of the compass, a dozen times or more. But perhaps the most amusing and expressive badger noise of all is the violent, explosive belch of disgust following acute alarm. Very frequently this occurs after letting off a flash-bulb. It is a gloriously vulgar noise that still makes me chuckle whenever I hear it.

Some other Habits Observed Among the experiments I have been making this year, is the laying of foodstuffs on badger paths, clear of the sett, to test their attractiveness or otherwise to the badgers. Honey in comb was avidly accepted, and other readily accepted foods were raw rabbit's liver, sliced turnip, cockchafers and a mass of garden snails. A cub discovered the last and signified approval in the usual manner ! Fresh rabbit gut was taken after some hesitation, a portion of cooked potato was merely sampled, and some ripe strawberries were eaten with apparent relish. Rejected foods included a piece of very "ripe" Gorgonzola cheese and a rather "high" dead young rabbit (each of these was refused with a snort of disgust and thereafter carefully avoided), an unbroken hen's egg and a raw herring. The snag in this kind of experiment is the great difficulty of ensuring that no trace of human scent remains after handling the various offerings. I have, I think, partially overcome this difficulty by putting each

foodstuff in a clean, closed container, without touching the food with the hands, and emptying it on to a badger path some hours before the badgers are likely to be out. But even so, it is risky to place too much reliance on the various acceptances and rejections as detailed above. Later on, I hope to extend my experiments and to discover some really certain method of eliminating the human scent. I propose to include the many kinds of food which my various tame badgers would eat, as well as those which wild badgers are known or believed to eat—a truly ambitious programme. I am told that these experiments are not "scientific". That may well be so, for I am no scientist ; but, at least to me, they are very interesting, and may quite possibly be useful.

Ernest Neal, in his fine book *The Badger*, states that badgers mate in July and August, and I am able to offer some evidence in support. At my sett, courtship began this year in the third week in July, and one pair of badgers certainly mated on July 27. The courtship "display" includes the rubbing or at least the touching of noses, and a slow, shuffling pursuit of the sow by the boar, the latter making a curious crooning or purring noise the while.

Here I would pay a sincere tribute to the excellence and accuracy of Neal's observations. Much of his work was of a pioneer nature and many of his discoveries were new. With one exception, my experiences have tallied with his, and in more than one instance a remark of his has opened up to me new possibilities and suggested further lines of research. The exception to which I refer is the habit of scratching, just after emerging from the sett, attributed to badgers, not only by Neal but by several other observers, one of whom went so far as to say that the first action of *all* badgers on leaving their setts is to scratch vigorously for some time. Now it is a curious fact that, although, this year, I have seen at least three badgers on each of twenty-four out of twenty-seven nights, and those at fairly close quarters, never once have I seen any of them scratch at all. That they must scratch sometimes is obvious, for there is no cleaner animal, nor one that more assiduously keeps itself free from "lodgers". At the moment, I do not understand the failure of my badgers to conform to type, and I think that here is a matter that may repay further investigation.

Near almost every sett that I have seen there has been a favourite tree on which the badgers clean their claws. At my sett this tree is a very large old oak standing within the confines of the sett itself, and, as will be seen from one of the photographs in the art inset, its trunk has been heavily scored up to full adult badger reach. I find that, as a rule, the badgers use this tree after returning from their night's foraging, an hour or so before dawn and just before retiring to the sett to sleep. Only once have I seen a badger claw the tree in the evening. All the badger setts I have seen had leading from them well-defined paths which were regularly used. One that I measured this year in a West Devon wood ran unbrokenly for 130 yards to the nearest field. Another was a veritable highway, worn bare by the feet of many generations of badgers.

At certain times of the year badgers enlarge and clean out their setts, and some of the heaps of debris resulting from this work need to be seen to be believed. It is by no means uncommon to find mounds of earth weighing a cwt. or more. In this will be sticks, rubble and stones of considerable size ; I weighed one ejected stone this spring at 7 lb. 3 oz. It is, of course, well known that badgers periodically renew their bedding, throwing out the old and replacing it with fresh material. In my district, the favoured items are bracken, moss, dead leaves and grass, in that order.

A local sow badger once brought off a good and very practical joke at my expense. I had cut and laid out to dry a large heap of bracken for use on a new hide. Going one morning to build this, I found that overnight the badger had transported the bracken to her sett, and that there was a trail of it right down into one of the entrance holes ! No doubt any human scent had worn off, and the badger, recognizing a good thing when she saw it, seized the opportunity of getting a fine supply of new bedding at the cost of comparatively little labour.

The Individualist It is, I think, fitting to end this article with the story of the small cub which is the subject of another of the photographs. This cub was very much a "character" ; at all times cool, nonchalant, independent, and with an almost contemptuous disregard of humanity as represented by myself. Whereas perhaps ninety-nine badgers in a hundred will bolt for earth a split second after a photographic flash-bulb is let off, this cub cared not one whit for anything of the kind. After I had let off a flash-bulb at it for the first time I found to my surprise that it had not moved. Nor did it do so when I came out of hiding, stood within full view, waved my arms and shouted at it from a range of about fifteen feet. I even threw a small stick at it, and then at last it did move. It toddled slowly and resignedly to the sett, with a backward look which to my fancy seemed to hold more of annoyance than alarm. Twice since that first occasion it has more or less repeated the performance, and I have never seen another badger cub that acted like it. It is, perhaps, hardly necessary to add that this is the cub that is so persistently late on parade ! This cub is different in another way, for it is markedly darker in colour than the rest of the litter. I believe it to be a fact that, until my arrival at the sett, it had not seen a human being, but neither had the two remaining cubs of the litter which, like their parents, will dive headlong for cover at a flash and stay down for a very long time. I can only hope that this very entertaining cub's indifference to, or contempt for, man will not persist long enough to lead it into danger. Meanwhile, it has stressed for me, once again, that wild animals do not always react in the expected way.

THE MINISTRY'S PUBLICATIONS

Since the date of the list published in the September 1952 *issue of* AGRICULTURE (*p.* 296), *the undermentioned publications have been issued.*

MAJOR PUBLICATIONS. Copies are obtainable, at the prices quoted, from the Sales Offices of H.M. Stationery Office or through any bookseller.

Bulletins

No. 48	Rations for Livestock (*Revised*)	4s. 0d. (4s. 3d. by post)
No. 154	Grassland Management (*New*)	3s. 0d. (3s. 2d. by post)

Other Publications

Smallholdings Centralized Services (L.S.A. Annual Report 1950-51) (*New*)	2s. 0d. (2s. 1½d. by post)
A.B.C. of Preserving (*Revised*)	1s. 6d. (1s. 7½d. by post)

LEAFLETS Up to six single copies of Advisory and Animal Health Leaflets may be obtained free on application to the Ministry (Publications), 36-38 Chester Terrace, Regent's Park, London, N.W.1. Copies beyond this limit must be purchased from a Sales Office of H.M. Stationery Office.
Copies of Fixed Equipment on the Farm Leaflets are available under the same conditions as for Bulletins (see above).

Advisory Leaflets

No. 53 Tomato Verticillium Wilt (*Revised*)
No. 235 Chafer Beetles (*Revised*)
No. 247 Seed Testing for Farmers (*Revised*)
No. 397 Rearing Turkeys (*New*)
No. 404 Heating of Grain (*New*)

Animal Health Leaflets

No. 12 Blackhead in Turkeys (*Revised*)
No. 16 Louping Ill in Sheep (*Revised*)
No. 43 Lead Poisoning in Calves (*New*)

Fixed Equipment of the Farm Leaflets

No. 17	Preservation of Timber and Metal (*New*)	9d. (10½d. by post)
No. 18	Marling and Claying (*New*)	9d. (10½d. by post)

FREE ISSUES Obtainable only from the Ministry (Publications), 36-38 Chester Terrace, Regent's Park, London, N.W.1.

Growmore Leaflets

No. 26 Storing Vegetables for Winter Use (*Revised*)
No. 37 How to make Compost (*Revised*)
No. 84 Rations for Livestock ; Winter Period Sept.-Dec. 1952 (*Revised*)
No. 107 Winter Root Crops for the Small Grower (*Revised*)

Other Leaflets

Grants for Farm Water Supply Schemes (*New*)

FARMING AFFAIRS

Logs to Burn It is a matter of regret that so many of the old country customs attendant upon Christmastide are now merely nostalgic memories of old men or interesting material for the social historian. The twelve days of generous holiday feasting, merrymaking and open hospitality that once marked the season, in worker's cottage and squire's hall alike, have dwindled sadly and often are honoured by but prosaic observance. Who now makes beef and plum puddings or plum pottage? What has happened to the goose pie, with its luscious crust of barley meal, once so popular in the North? What of the wassail bowl of spiced ale, and the wassailers themselves, remembered now only in an occasional carol? In how many West Country orchards will the health of the apple trees be drunk in a wassail bowl of cider, and shot fired through the bare branches to court the bounty of next year's harvest? Where, too, are the mummers and the waits "full-throated in the frosty air"?

Not the least exciting of these pleasant customs was the bringing in of the yule log—a labour to which, with many a quip and jest, everyone gave a hand. Today, less ceremoniously, the coppice and spinney on many a farm will still be combed for Christmas fuel, and many a family will sit, as did its forbears in more spacious days, in the light of a good log fire and let their fancy play among the flame shadows that dance upon the walls. The old rhyme comes to mind:

Logs to burn; logs to burn;
Logs to save the coal a turn.

Here's a word to make you wise
When you hear the woodman's cries;
Never heed his usual tale
That he has splendid logs for sale,
But read these lines and really learn
The proper kind of logs to burn.

Oak logs will warm you well,
If they're old and dry;
Larch logs of pinewoods smell
But the sparks will fly.
Beech logs for Christmas time;
Yew logs heat well;
"Scotch" logs it is a crime
For anyone to sell.

Birch logs will burn too fast;
Chestnut scarce at all;
Hawthorn logs are good to last
If cut in the fall.
Holly logs will burn like wax,
You should burn them green;
Elm logs like smouldering flax,
No flame to be seen.

Pear logs and apple logs,
They will scent your room;
Cherry logs across the dogs
Smell like flowers in bloom.
But ash logs all smooth and grey,
Burn them green or old;
Buy up all that come your way,
They're worth their weight in gold.

S.R.O'H.

Farming Cameo : 25. The Trowbridge-Devizes District Situated in the mid-western part of Wiltshire, this district extends 15 miles northwards from the fringe of the Salisbury Plain, which forms the natural southern boundary, and some 20 miles eastwards from the borders of the adjoining Bath district to the edge of the Pewsey Vale country.

The greater part of the area lies in the valley, and farming interest centres mostly around dairying and intensive milk production. The soils are mainly heavy, deriving from Oxford and Kimmeridge clays, but, on the eastern fringe, there is an area of chalk, and here, at an elevation of 600 feet, there are a number of large, mixed, arable farms—some exceeding 1,500 acres. In the west and north-west too, where the clay changes to oölitic limestone, the farms tend to be mixed, with a high proportion of arable land. Some of the land is deficient in lime, but, in the main, drainage problems, the insufficient use of phosphates, and the need for improved grassland management techniques are the limiting factors to increased production.

There are 1,453 holdings in the district, comprising a total acreage of 108,000 acres : 737 of these holdings are under 50 acres, 203 are between 50 and 100 acres, 406 are between 100 and 200 acres, and 107 holdings are over 200 acres. Livestock includes 20,000 dairy cows and 17,000 other cattle, 16,000 pigs, 3,500 sheep, and 230,000 head of poultry. During the past few years most of the medium-sized grass and arable farms, in addition to specializing in milk production, have considerably increased the numbers of pigs and poultry kept, while registered T.T. herds now number 260. Practically all the well-known breeds of dairy cattle are represented, with Shorthorns and Friesians to the fore.

Within the district are the towns of Westbury, Melksham and Bradford-on-Avon, and, as a result, there is a large urban intrusion into the surrounding agricultural land. The continual requests which are made for the release of land for purposes other than agriculture create a serious problem and tend to disrupt agricultural production.

Silage-making has always been popular in this area, and the great majority of medium-sized grass farms favour this form of conservation. Of the methods used, the surface clamp and stack are the most common. It is interesting to record, too, that, judging from the many samples received in the annual silage competition, the quality of the product is improving. To help out with the feeding, heavy-land farmers have also been encouraged to incorporate the ley in their system, and to grow kale and green forage crops for winter milk production.

P. G. Swann,
District Advisory Officer

World Production of Oilseed Crops Although slightly less than that of the previous year, the world production of oilseed crops in 1950–51 was appreciably higher than before the war ; the decline on the 1949–50 figure was due mainly to a sharp fall in the supply of olive oil. Preliminary figures for 1951–52 indicate a further marked increase in output. Even allowing for the much greater population during the last decade, the quantity of *vegetable oils* available *per head* is still slightly above the comparable pre-war figure. The rise in the production of *fats and marine oils* has, however, not been so spectacular and, on the same basis, i.e., availability per head of population, the total for all classes of oils and fats in 1950–51 was slightly below the 1934–38 average.

The above facts and many others concerning the production, consumption, international trade and use made of oilseed crops are brought out in the Commonwealth Economic Committee's publication *Vegetable Oils and Oilseeds*.*

In keeping with other annual reviews by this Committee, special reference is made to the by no means insignificant part played by the Commonwealth countries. In terms of oil equivalent, the world produced, in 1950–51, over 16½ million tons of the principal oilseed crops, of which the Commonwealth's share was over 3½ million tons and that of the United Kingdom, in particular, about 5,000 tons. The largest Commonwealth producer was India with over 2 million tons, although India's pre-war position as the leading exporter of oil crops in this group has now been taken by Nigeria.

The net supplies of vegetable oils and oilseeds entering world trade during 1951 amounted to some 3.9 million tons, in oil equivalent, and were 2 per cent greater than those in 1950. Of these, the United Kingdom net import, measured as oil, was over 1 million tons, compared with some 650,000 tons in 1938. Indeed this country is now the largest importer of oils and oilseeds. (The Ministry of Food is, of course, the sole importer of all the main types, the greater part being purchased under long-term agreements with Commonwealth producers).

There is, naturally, a wide difference between the oil equivalent of crops and the amount of oil extracted from them, since, apart from seed requirements, large quantities of seed may be directly consumed or prepared for food without crushing for oil. Nevertheless, a significant post-war development in world trade in vegetable oils and oilseeds has been the increased proportion shipped as oil, as opposed to seed, following the expansion of crushing plants in many important seed-producing countries. In consequence, crushing facilities in several Western European countries, particularly Germany, are not being used to the full. As an example, the actual weight of seed crushed in the United Kingdom in 1951 was little more than 1 million tons, compared with an average of 1½ million tons for the years 1935–38.

Soil Survey of Great Britain The appearance of the fourth report of the Soil Survey of Great Britain presents an opportunity of saying something about the survey in general and its place in agricultural affairs. It is not necessary nowadays to dwell on the importance of soils : the danger of unchecked erosion in large areas of the world, and the loss of agricultural land for industrial and urban purposes in small countries is now widely recognized. Soil has rightly taken its place as the fundamental asset. This being so, the scientific study of the origin of soils and their detailed classification, as carried out by the Soil Survey, needs no justification. It is a very necessary stocktaking and cataloguing of our soils to fit them into the world picture and indicate their qualities and potentialities.

The work started at the beginning of the century, the basis being the relationship of the surface soils to the rocks from which they were derived. In England, where the climate is fairly uniform, this approach met with some

* Obtainable from H.M. Stationery Office, or from The Secretary, Commonwealth Economic Committee, 2 Queen Anne's Gate Buildings, Dartmouth Street, London, S.W.1, price 5s. (5s. 3d. by post).

success, but over wide continental areas a system based on the examination of the whole "profile" from surface to underlying rock or drift, and taking into account the full effect of climate, was found to be more satisfactory. This method of classification was adopted here in the 1920s and has continually been brought into line with the more extensive surveys carried out in the U.S.A. and elsewhere. Since 1946 the Soil Survey of England and Wales has been domiciled at Rothamsted, where it is closely associated with the Pedology department. The Scottish Survey is centred at the Macaulay Institute, Aberdeen. All the work is under the control of a special Soil Survey Research Board of the Agricultural Research Council. The English survey now has a director and sixteen field surveyors ; in Scotland the staff is slightly smaller. Up to the present, some $1\frac{1}{4}$ million acres have been surveyed in England, and $1\frac{3}{4}$ million acres in Scotland.

Surveys are carried out on ordnance maps of different scales—1, $2\frac{1}{2}$, 6 or even 25 inches to the mile being used according to the purpose in view. The small scales are used when it is necessary to get a relatively quick picture of the soils of a wide area. On the larger scales, smaller areas and even single farms are mapped in much greater detail, if necessary, many cores and several profiles being examined within the limits of a single field.

Just as the country has long had its ordnance and geological maps, the activities of the Survey will, in due course, provide soil maps backed by an index of soil types providing the more detailed chemical, physical, and descriptive information required by soil users whether planners, engineers, or farmers.

Annual reports of the Survey are available from 1947 onwards. They give an account of the geology, topography, and agriculture of the areas surveyed in Great Britain. The soil series are named, placed in their main soil groups, and classified by their parent materials and drainage conditions. A profile description is also supplied.

Although the main purpose of the Soil Survey is to prepare a soil map of Great Britain, so many bodies urgently require detailed reports on certain areas of land in which they are interested that surveyors are often detached from their primary job to look into these special problems. Planning authorities, the Forestry Commission and fruit growers, to name only a few, are frequently seeking the help ot the Survey. A most valuable and essential activity, however, is in connection with the farms of research stations, the N.A.A.S., county farm institutes ; in fact, anywhere concerned with agricultural or horticultural experimentation in the field. It is obviously of great importance to define the situation of different soil types within such a farm, and by relating them to similar areas elsewhere, to give a wide applicability to the results. For this kind of work, mapping on the scale of 25 inches to the mile is normally adopted to record the necessary detail. A knowledge of the fertilizer responses on the various soil series benefits the survey as well as the experimenters immediately concerned.

The Soil Survey in its present organization is young, and a very great area of the country still awaits its attention. It has made a promising start, and, through its many contacts, it is gradually building up a following. Some of them may not be interested in the technical details of soil classification, but all are closely concerned with its practical relationships.

H. V. Garner

BOOK REVIEWS

The New Yeomen of England. J. WENTWORTH DAY. Harrap. 15s.

We all know what we are going to get from Mr. Wentworth Day, shrewd observation of men, farms and wild nature, a lively prose style which makes even written dialect not merely tolerable but enjoyable, immense gusto and a Thing, a big, bad Thing about experts, officials, intellectuals and planners and all their works. This book well maintains the tradition he has established. The title may have altered but theme and language remain the same. The High Old Times may have gone, but the Good Old Days still continue as before.

In theory, this book discusses that substantial minority of farmers who own the land they cultivate. In fact, it is a discursive account of a series of visits to prominent landowners and farmers in the south and east of England. Lord Rayleigh, Lord Iveagh and the Duke of Grafton are but the most famous of the many "yeomen" whose methods and achievements are discussed in considerable and well-illustrated detail. And a magnificent story it is. These men are the heirs of the old "improvers" and the country owes much to them. The parallel with the Agricultural Revolution is, indeed, clear. But it is not complete. The author has much to say on the inadequacy of the rents on which the landlord depends for the maintenance and improvement of his property. The landlord-turned-farmer is one of the significant figures of this book.

Taken alone, however, *The New Yeomen of England* is a misleading guide to modern farming reality. It describes the general staff of the agricultural army, not the men who command its companies and platoons. The countryman will see this at a glance. The urban reader may not, and is therefore advised to follow the spacious Mr. Day with a study of the narrower, harder and far more representative Mr. Henderson.

N.H.

Forestry in Farm Management (2nd Edition). R. H. WESTVELD and R. H. PECK. Chapman and Hall. 40s.

This comprehensive and well-illustrated text-book describes American practice, but the problems that face a farmer owning a small acreage of woodland are much the same in America as in Britain. Every farmer is familiar with the raising and harvesting of an annual crop, but he does not always appreciate that tree crops can also be harvested annually. Under skilled management, only a few of the trees are felled, or thinned out, each year. New trees are planted to make good the loss, and so together with the remaining trees, the yield of timber can be profitably maintained indefinitely. Meanwhile, the woods continue to give their subsidiary benefits such as shelter from wind, cover for game, nesting sites for useful birds, control of stream-flow, and pleasure to the eye. All this can spring only from continuous growth, and the authors rightly stress that woodland must be maintained in a healthy condition by skilful planting, regular tending, and protection against harmful animals, insects, diseases, and fire.

The hand-planting tools used by the American forester are much the same as our own; but, as we have no smooth prairies for afforestation, we are unlikely to use his tree-planting machine which, working on the principle of a cabbage planter, enables two men to put in 10,000 trees a day. The rabbit, which has wiped out so many small plantations in Britain, is not considered a serious pest in America, and wire netting is seldom used ; neither does the grey squirrel, though a native of America, figure on the list of the forester's foes. British farmers are fortunate in that their woods are usually surrounded by fields, as this diminishes the fire risk that is so serious in the United States. Our system of measuring trees for sale seems better than most of the forty (!) systems used in different parts of America ; the majority of these have obviously been thought up by timber merchants, and give the unfortunate grower—quite literally—the " wrong end of the stick," for the logs are only measured at their *thin* end !

The American farmer may have profitable by-products from his woods, e.g., Christmas trees, maple sugar, and resin and turpentine tapped from certain pine trees, for, as in British farm woodlands, it is sometimes the minor produce that shows the major profit.

The growing development in both countries is the provision of technical forestry advice to farmers, both by government agencies and private consultants. The authors have included a chapter in this edition to cover such new aids in the United States. In Britain, we have the Private Woodlands Officers of the Forestry Commission, and a system of grants for planting small woods, shelterbelts, or individual poplar trees ; also for thinning young plantations, which is of substantial assistance to the woodland-owning farmer.

H.L.E.

Estate Forestry. SIR W. L. TAYLOR. Crosby Lockwood. 15s.

For the second time Sir William Taylor, formerly Director-General of the Forestry Commission, has written a very readable book on forestry. In his first book, *Forests and Forestry*, he gave a broad picture of the history of forestry and his views on its future in Great Britain. This present book, addressed to owners, agents and foresters, deals with the part to be played by private woodlands in the national programme. It is an important part, for they must provide two million acres out of the five million acres of well-managed forests required during the next fifty years ; the recent census of woodlands has shown that, of the one and a quarter million acres of high forests surviving in private ownership, one-quarter is poorly or badly stocked.

Very sensibly, the author avoids going into the detailed technicalities of forestry, which are available in standard text-books and in the Forestry Commission's publications, but, at the same time, he does not limit himself to general theories and principles. Instead, the book approaches the subject in a practical way and contains many useful tips gained over a lifetime's experience of forestry. The chapter on plant supply and the estate nursery, so often the graveyard of the hopes and plants of the over-enthusiastic amateur, is particularly helpful.

Although accustomed to dealing with the nation's forests, Sir William Taylor is fully alive to the problems of private owners and their advisers. He considers with care such subjects as marketing, forestry and the farm, co-operation on private woodlands, income tax, and last, but not least, the economics of private woodlands. The book finishes with an informative bibliography and a short summary of the Forestry Act, 1951.

A.J.L.

The Islands of England. J. H. INGRAM. Batsford. 15s.

From their earliest years, most people find something rather attractive about an island—an attraction which frequently varies in inverse proportion to size. England has some forty or more islands, large and small, off her coasts, and it is amongst these that the author invites exploration.

Beginning with Holy Island and passing to numerous islands along the east, south and west coasts of England, thence to the Isle of Man and the Channel Islands, the author, who has lived and worked on several of the islands, gives a brief account of their history, fauna, flora, geology, agriculture, tourist industry, legends, customs, folk-lore, or whatever there is of outstanding interest. Some of these islands, such as Farne, Coquet and Hilbre, are small and uninhabited, others are occupied by one family (Ramsey), still others (Lundy) are isolated and almost inaccessible, while some are relatively large and densely populated, for example, the Channel Islands. But these factors do not determine the text space allotted, for example, the Isle of Man with its seat of government, its many thousands of inhabitants and tourists, and its agriculture, is dealt with in five pages, whilst Bardsley, of less than one square mile, is allotted no less than nine pages.

Many islands are referred to in the book, hence the reader should not anticipate a detailed account of each ; nevertheless the author has managed to include, in a pleasant readable form, much that is fascinating. A reliable, succinct account is given of the complex history, outstanding sights and present-day activities, including agriculture and horticulture, of the delectable, self-governing Channel Islands. But one error is noted : a Jersey *vergée*, is equivalent to four-ninths of an acre, not 2¼ acres.

The Isle of Wight, which attracts thousands of holiday-makers regularly every summer, is described, with its Roman Villa, famous yachting clubs and regattas, its chines and cliffs, and the bay of multi-coloured sand. But, it is a notable omission that little or nothing is said of the Island's farming, which is not the least of its activities !

There are 194 pages, 74 well-produced, attractive illustrations, 4 pages of helpful maps, and an index.

T.S.

BOOK REVIEWS

Chrysanthemum Growing. W. E. SHEWELL-COOPER. Allan Wingate. 15s.

Books dealing with chrysanthemum growing are becoming legion, and Mr. Shewell-Cooper is therefore to be congratulated on his courage in offering yet another.

This one, which the publishers claim is a simple authoritative handbook designed for both novice and expert, has much to commend it, but is marred by many annoying and indeed erroneous features. Thus while information about the N.C.S. classification of chrysanthemums is given, with examples, I feel that greater use could have been made of the coloured illustrations of varieties by including them in the classification. Again, while the book contains the unusual feature of a glossary as an early chapter, the use in it of the term "sucker" is to be deprecated and its implication discouraged. It is also stated that suckers are synonymous with basal growths but the definitions given of the two by no means agree. The detailed reference to *p*H values is, however, a praiseworthy inclusion.

Subsequent chapters deal with care of the stools, raising of cuttings, soil mixture and feeding, stopping, the cultivation of earlies out-of-doors, and pot culture in greenhouses. Warm-water treatment for chrysanthemum stools as a protection against eelworm is dealt with in the first of these chapters, although the period of treatment has been misquoted; 110°F. for 30 minutes would prove detrimental to most varieties. The section on propagation is reasonably comprehensive, but it offers no clear definition of "stem cuttings", while Fig. 1 does not tally with the text on page 36, and Fig. 2 is poorly executed, showing no terminal bud. It is also surprising to find the author suggesting in the chapter on plant raising that early-flowering varieties can be left in boxes until planted out in the open. Amateurs usually prefer to pot these in 60's, and the commercial grower would obviously bed them in cold frames. The suggestion that the feeding of plants that are going to be "lifted in" to the greenhouse should cease when the blooms show colour, is a doubtful recommendation.

Apart from a reference to midseason varieties as second earlies, the difficult subject of "stopping" is explained very satisfactorily.

Diseases and pests are dealt with in a very thorough manner, although I would have liked to have seen a little more space devoted to Aspermy virus, and, particularly in a book which is intended for amateurs, a stronger warning might have been given about the care to be exercised by users of parathion and HETP.

In dealing with varieties and descriptions I think the author has gone too far. Chrysanthemum varieties should be reduced to a minimum, and it cannot be other than confusing to the reader to have 936 varieties offered to him in the course of 26 pages.

Nevertheless, despite its aggravating style—the frequent references to other chapters, the repetitive mention of certain practices, the impression of too much padding and insufficient factual information—the book may well prove a useful guide to the beginner.

J.H.

Black Country (Regional Books Series). PHIL DRABBLE. Robert Hale. 18s.

Mr. Phil Drabble writes with affection and intimate knowledge of his native heath, its development and integration and its people—not the modern stereotyped industrial population, but the surviving remnants of the much-maligned, uneducated but stalwart craftsmen of days gone by, the "little men", jaunty, coarse, courteous, tough, shrewd and lovable. These admirable fellows come alive in his pages again and again. They derive, it seems, direct from the virile peasant stock that once farmed this country before it became (allegedly) black with smoke, yet whose agricultural fortunes there began to wane when its original blackness, the Black Death, swept over the land. Sheep replaced corn, and serfs became free tenants, but as the centuries passed the prospects grew bleaker again, and vast numbers of the peasantry were easily lured to industrialism by the newborn prosperity of coal, lime and iron. These real Black Countrymen linger on today, take rich pride in their craftsmanship, use strange peculiarities of speech that hark back to Chaucer, and show their true origin by the hard and serious recreations they pursue—whippets, pigeons, cock-fighting, poaching and the rest. Mr. Drabble laments the passing of this type of industrial peasant, as he bewails the continuing rape of Staffordshire soil; yet he pictures most vividly the pathetic but plucky farming that still hangs on inside the industrial regions, refusing to be displaced, like the kestrels and owls and foxes and flowers that thrive just behind the factories and the slag-heaps. This book is exceptionally interesting, full of nice prejudice and rewarding candour, and helps most effectively to present to the reader the just balance between factory and farm on our soil today.

D.G.

Surrey. RALPH LAWRENCE. Paul Elek. 15s.

The language of the common guide book, as of the formal text-book, is so familiarly stilted that to find one written pleasantly, even entertainingly, is most refreshing. The publishers describe their long series of county guides as "personal" books, and the volume under consideration amply justifies the epithet. Of course, as a Surrey resident, I may be forgiven for holding the view that Mr. Lawrence was dealing with a county so full of interest and beauty that he could scarcely fail to make a fascinating book ! This complacent approach was soon shaken, however, when I found that I was not familiar with a tithe of the beauty spots or points of historical interest in the county, and had only dimly realized that Kew was within its boundaries.

Beautiful, Surrey undoubtedly is ; agriculturally, even the most ardent Surrey lover could scarcely rate it very high, and he is apt to console himself with the fact that William Cobbett, " the presiding genius of Surrey," was born and buried at Farnham. The horticulturists take quiet pride in remembering Gertrude Jekyll of Munstead ; the musicians pay tribute to the Dolmetsch family of Haslemere ; and the literary folk have a host of connections to quote—from Lord Tennyson's house at Blackdown, to Samuel Pepys' appreciation of the Guildford asparagus : " the best I ever did eat in my life."

The line drawings, which illustrate the book, are delightful, as are the well-chosen photographs. It is a book every Surrey resident should possess and, having read it, would wish that the unfortunate residents of lesser counties could possess it too ! The only blemish I can find is that my own village of Grayswood is nowhere mentioned, but perhaps it is only Grayswood residents who would find this omission incomprehensible !

R.H.

The Daffodil and Tulip Year Book, 1951-2. Royal Horticultural Society. 15s.

Few works combine so well the scientific, the practical and trade aspects as this *Daffodil and Tulip Year Book*. It is one of the most versatile the Society has produced. Splendidly illustrated with some 26 excellent photographs, it runs to 213 pages of reading matter, with an index covering the present and past issues.

The commercial show reports emphasize how the plant-raisers' efforts have been brought in great bounty to the town-dwellers by the increased and improved production of the commercial flower-grower.

Two outstanding chapters are those on the development of the narcissus plant, whilst that on the dwarf-growing species of narcissus is a real mine of information on these gems of the family.

A number of chapters deal with the popular aspects of raising, production, exhibiting, garden decoration, and even forcing. The consideration of the newer varieties is most valuable. Daffodil-growing in Australia and New Zealand is brought into focus by a survey on the behaviour of varieties grown in the U.S.A. The history and cultivation of tulips is also covered.

The book gives an interesting as well as informative survey of matters connected with these two important bulb flowers and should prove a valuable addition to the literature on the subject.

H.W.A.

What Flower is That ? E. M. BARRAUD. Littlebury. 10s. 6d.

Miss Barraud summarizes the limitations of this book in a paragraph of her introduction: " It is not scientific, on the other hand it is not anti-scientific, so to speak. It is quite frankly only an attempt to help beginners in getting to know the wild flowers of our countryside". The book is a laudable attempt to arouse interest in flowers amongst those who know little or nothing about botany and who instinctively fight shy of botanical names and terminology. The avoidance of scientific terms may seem desirable to the beginner, but it is to be feared that the brief descriptions of plants and the unscientific drawings which accompany them will often be found inadequate aids to identification. The only key is one based primarily on flower colour, with the number of petals and the shape of the flower or inflorescence as additional clues. The last chapter, entitled " What Next ? ", serves as a brief introduction to elementary botany and recommends more orthodox books for further reading.

S.G.H.

Bantams and Miniature Fowl. W. H. SILK. Poultry World. 10s. 6d.

Mr. Silk's reputation in the world of miniature fowl is well established, and it is good to find so keen an exponent of the "little uns" taking the trouble to put them in their true perspective by frankly stating their limitations. The book reminds one of the fifth age of man described by Touchstone, as it is "full of wise saws and modern instances," and there is a phrase in the nutrition section which should be engraved on the hearts of all bantam and miniature breeders "never *feed* for small size : *breed* for it instead". Much of the earlier damage to the reputation of these fowl undoubtedly stemmed from lack of stamina produced by failing to follow this dictum.

The book is generally well written and covers nearly every aspect of the subject, and it should find a place in the library of every poultry-keeper, whether he keeps bantams or the standard breeds.

A serious criticism of the book concerns the chapter on parasites and diseases which, in view of some of its condensation and some of its inaccuracies, would have been better omitted. Some examples of the inaccuracies are as follows : to say in 1950, when this book was written, that no treatment for coccidiosis is at present advised is to deny the existence of the extensive work done in this country and in the U.S.A. ; to confine the cause of rickets mainly to lack of vitamin D, without any reference to the calcium-phosphorus ratio, is to give an entirely false picture, while the recommendation to feed 2 per cent cod liver oil may well bring its own attendant troubles ; and finally to include "curly toe lameness" (due to riboflavin deficiency) as another form of rickets shows lack of understanding of these two disorders, since the former is neurological and the latter osteodystrophic. Apart from this chapter, the book is one for which the author deserves the congratulations and thanks of the poultry industry.

W.M.A.

Correction

In the October 1952 issue, a book review was published under the title *Farm Implements and Machinery*. The correct title of this book is *Farm Tools and Machinery*. The author is H. J. Hine and it is published by the Oxford University Press, price 5s.

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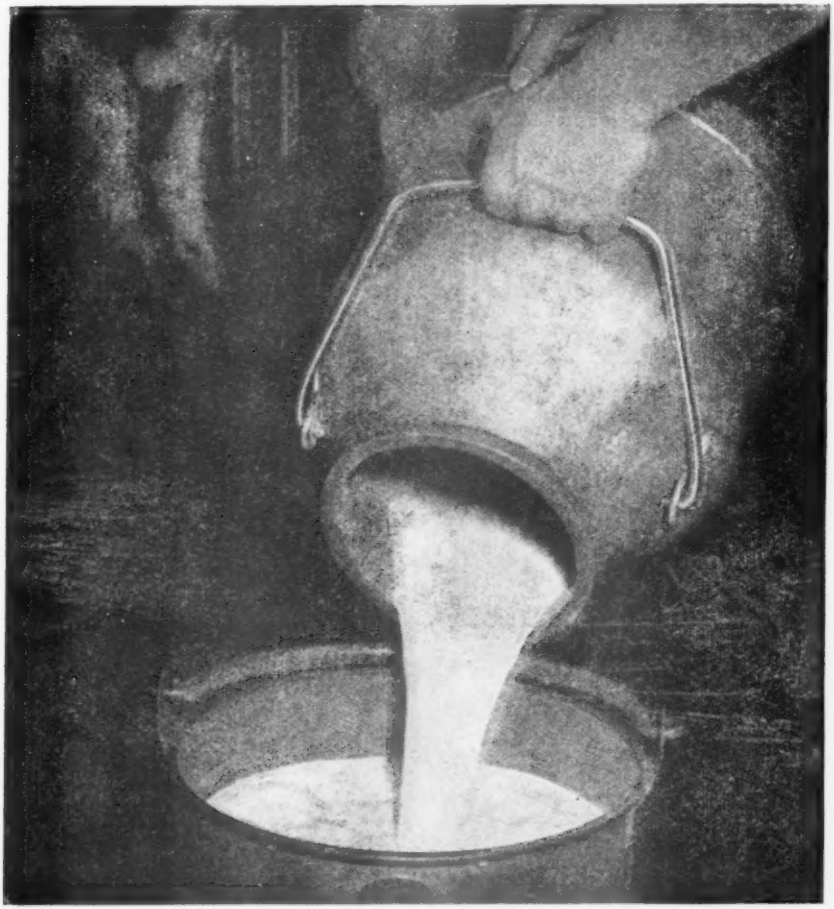

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